

**OPERATION AND MAINTENANCE
MANUAL FOR
WATTMETER CALIBRATION SYSTEM
MODEL 363/800**

MAY 1993

**AMERICAN MICROWAVE TECHNOLOGY
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SECTION 1.0

INTRODUCTION

1.0 INTRODUCTION

This manual contains operation and maintenance instructions for the Model 363/800 Wattmeter Calibration System and the replaceable components. The manual is divided into eight sections.

Section 2 provides a general description of the 363/800 system with a tabular listing of pertinent data for the system and its components

Section 3 provides an overall functional description of the system.

Section 4 provides a tabular listing of equipment operating controls and indicators keyed to illustrations of the equipment. Included are instructions for the interconnection, start-up, operation, and shut-down of the unit.

Section 5 contains procedures necessary to adjust and calibrate the equipment to ensure proper operation.

Section 6 contains procedures necessary to maintain the equipment in a serviceable condition. Included are procedures for preventive maintenance, and the replacement instructions for repairable modules.

Section 7 provides troubleshooting procedures to determine equipment malfunctions, probable causes, and the steps to correct the malfunction.

Section 8 provides an illustrated listing of the electrical components contained in the system. A numerical index, by part number, is provided at the end of the parts listing.

SAFETY PRECAUTIONS

WARNING

The Model 363/800 Wattmeter Calibration System operates at radio frequencies up to 1000 megahertz and at power levels up to 800 watts, which can cause lethal or severe radiation burns to personnel if recommended safety precautions are not strictly observed. The human eye is at a particularly high risk of developing cataracts when subjected to repeated exposure to high-power levels of RF radiation. Do not operate exposed circuitry or radiating elements at high power levels when personnel must work in close proximity to the radiating source (particularly when close to the human head); always replace circuit shields during any high-power operations.

WARNING

Maintenance personnel must observe all safety precautions at all times. Do not replace components inside the equipment with the input power turned on. Under no circumstances should any person reach into an enclosure for the purpose of servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid. Remove power from the system for all procedures that do not require power. For those procedures that do not require power, be extremely cautious in handling test leads, tools, and equipment in the proximity of live RF circuitry. Always follow AMT's recommended procedures during any powered operation.

Hazardous line voltages exist within the subject equipment; avoid physical contact with these voltages to avoid injury.

The Wattmeter Calibration System can operate at frequencies up to 1000 megahertz and at power levels up to 800 watts, which together can cause lethal or severe radiation injury if recommended safety precautions are not strictly observed. Accordingly, personnel are warned not to stand near any active antenna or other radiating element. Do not disconnect the system RF output coaxial cable unless the system has first been placed in the **standby** mode. Similarly, hazardous RF voltages exist at the output stage of any active amplifier assembly, which should not be accessed unless the system is either in the **standby** mode or primary power is removed.

Personnel are warned that although no radiation hazard exists with the primary power line, physical contact with such voltages can be lethal. Primary line voltage (approximately 300 volt peak) exists in all four amplifier assemblies, whether active or not, and in the system controller.

Make sure that electrical power to the system is disconnected before proceeding with any maintenance action. Failure to comply may cause injury or death to personnel.

Total weight of a drawer is approximately 100 pounds. Make sure that sufficient personnel are present to support the drawer upon removal from the cabinet. One person should not try to remove the drawer by himself. Failure to comply may result in injury to personnel.

Only one drawer should be fully extended from cabinet at any time to prevent injury to personnel or equipment damage if cabinet topples.

CAUTION

Do not disconnect the RF output cable from a powered 363/800 unless the system is in **standby** mode and not capable of being remotely operated. Failure to observe this caution can generate transients and high VSWR that can damage the system or the test load.

Ensure that a minimum 12-inch clearance exists at the back of the system cabinet and that all air-venting ports are clear of obstructions. Failure to observe this caution can restrict cooling air and cause overheating failures in areas not monitored by thermal sensors.

Always ensure that an output RF cable and a suitable load are connected to the system before disconnecting or connecting a signal source to the input. Failure to observe this caution in a powered unit can generate damaging noise transients, which are greatly amplified through the linear amplifiers.

Do not disconnect any coaxial cable in series with, or connected to, the **RF output** panel connector unless the system is placed in the **standby** mode; failure to observe this caution can cause a load mismatch and excessive VSWR, which can cause the amplifier power ratings to be exceeded and cause equipment damage.

Always ensure that the test load being driven is of the proper impedance (50 ohms), adequate power rating, and is only being tested within its specified frequency range. Failure to observe this caution can cause damage to both the system and the test load.

SECTION 2.0

EQUIPMENT DESCRIPTION

2.0 EQUIPMENT DESCRIPTION

2.1 Introduction

This section provides a general description of the 363/800 Wattmeter Calibration System with detailed physical descriptions of the major assemblies. Pertinent physical and operational characteristics are provided in tabular form at the end of the section.

2.2 General Description

The 363/800 Wattmeter Calibration System (Figure 2-1) consists of four linear amplifiers, a system controller, and the necessary interconnecting cables. The equipment is housed in a double, 19-inch relay cabinet with provision for a signal source.

The amplifiers have self-contained power supplies and operate independently of each other, improving system reliability and simplifying servicing. The system will operate with one or more amplifiers removed, requiring only the elimination of the band of frequencies covered by the removed amplifier.

The purpose of the 363/800 system is to provide high power RF levels in continuous coverage from 2 MHz to 1000 MHz. This is accomplished by employing four high power, broad band amplifiers. The 363/30 amplifier provides 800 watts minimum from 2 MHz to 30 MHz. The 363/150 amplifier provides 200 watts minimum from 30 MHz to 150 MHz. The 363/500 amplifier provides 200 watts minimum from 150 MHz to 500 MHz. The 363/1000 amplifier provides 100 watts minimum from 500 MHz to 1000 MHz. The 363/488 system controller (filter switch box) provides several functions. The primary function is to connect the amplifiers in a matrix to enable the system to have one input and one output. Additionally, low-pass filters are switched in every 0.72 octave at 2 MHz, decreasing to every 0.38 octave at 1000 MHz, to lower the harmonic content of the output. The filters require 13 bands to continuously cover 2 MHz to 1000 MHz. The bands are named band A through band M; band A being 2 MHz to 3.44 MHz, band B being 3.44 MHz to 5.90 MHz, etc. The band switching function is IEEE 488 bus programmable, or user selectable from the front panel. In addition to band selection, the 363/488 control box has indicators for monitoring the system operation.

The 363/800 system is designed to be driven by a frequency synthesizer, crystal controlled oscillator, or other stable frequency source.

2.3 Specifications

Refer to Table 2-1 for a listing of pertinent physical data and electrical characteristics and to "Maximum System Power Output" sheet for a specific 363/800 serial number. The module relationship with identification is shown in Figure 2-2.

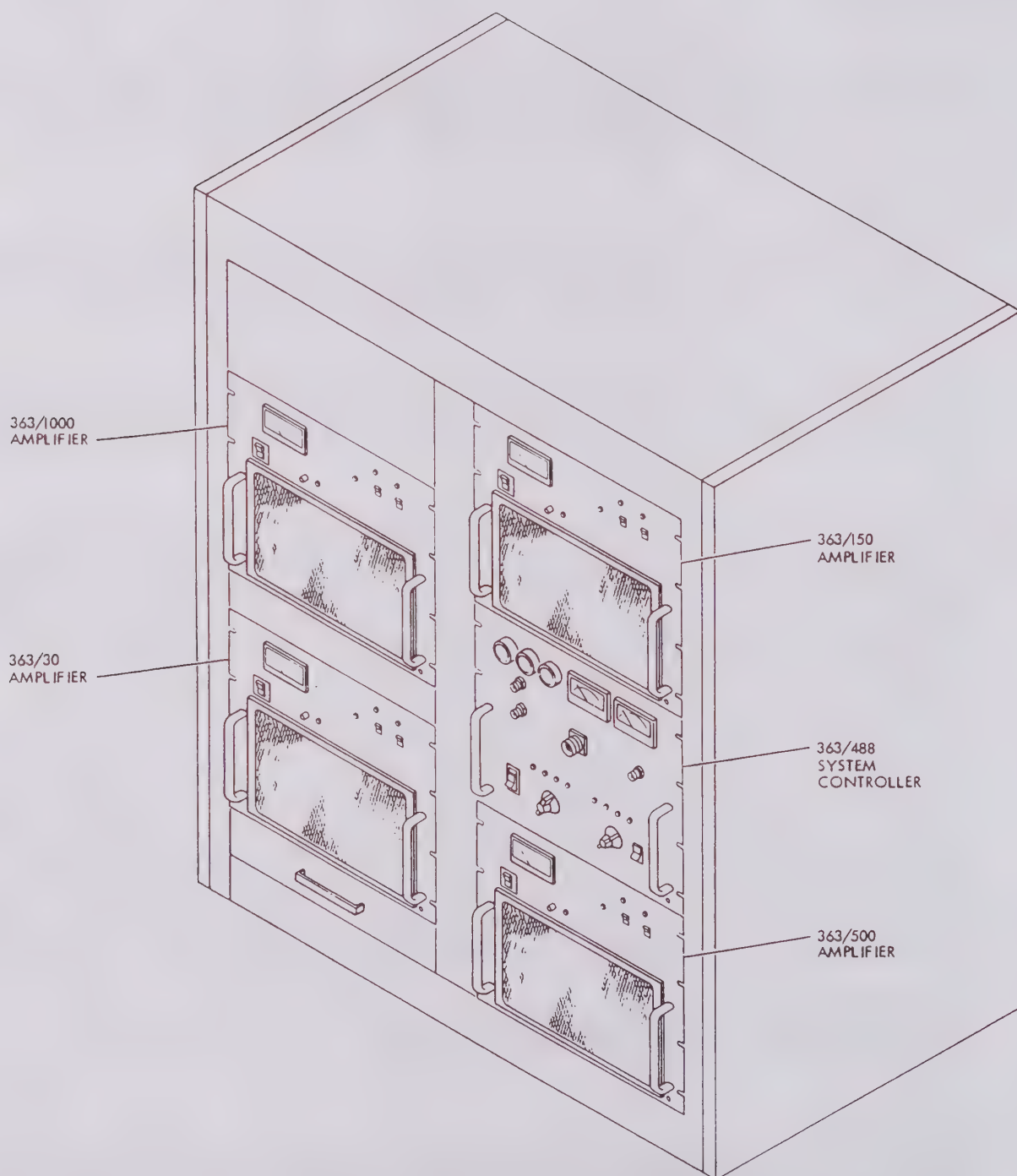


Figure 2-1. Wattmeter Calibration System, Model 363/800

Table 2-1. Leading Particulars

Item	Characteristics			
CALIBRATION SYSTEM:				
Model No.	363/800			
Cabinet:				
Type	Two-bay rack			
Dimensions (inches)	56.5 high x 46.2 wide x 25.0 deep			
Weight	900 lbs.			
Connectors:				
RF Input	N(f)			
Input Sample	N(f)			
RF Output	GR-900			
Output Sample	N(f)			
AMPLIFIER:				
Model No.	<u>363/30</u>	<u>363/150</u>	<u>363/500</u>	<u>363/1000</u>
Frequency Range	2-30 MHz	2-150 MHz	150-500 MHz	500-100 MHz
Power Output (50 ohms load)	800 W min	200 W min	200 W min	100 W min
Compression	1 dB max @ 500 W	1 dB max @ 120 W	1 dB max @ 120 W	1 dB max @ 50 W
Gain/Sens (max mW in for W out)	13 dB min (40 W for 800 W)	53 dB min (1mW for 200 W)	53 dB min (1 mW for 200 W)	50 dB min (1 mW for 100 W)
Gain Variation	±3.0 dB max	±3.0 dB gain	±3.0 dB gain	±3.0 dB gain
Harmonics w/filter unit at full rated output	-40 dBc max	-40 dBc max	-40 dBc max	-40 dBc max

Table 2-1. Leading Particulars (cont)

Item		Characteristics			
AMPLIFIER (cont):		<u>363/30</u>	<u>363/150</u>	<u>363/500</u>	<u>363/1000</u>
Spurious Response	-60 dBc min	-60 dBc min	-60 dBc min	-60 dBc min	-60 dBc min
Noise Figure	N/A	9 dB max	12 dB max	12 dB max	12 dB max
VSWR Protection (All phase angles)	Yes	Yes	Yes	Yes	Yes
Over Temp. (Shutdown)	Auto Reset	Auto Reset	Auto Reset	Auto Reset	Auto Reset
Operating Ambient	0-50° C	0-50° C	0-50° C	0-50° C	0-50° C
Output Meter (50 ohms load)					
High Range	±1 dB @ 800 W	±1 dB @ 200 W	±1 dB @ 200 W	±1 dB @ 100W	
Low Range	±1 dB @ 200 W	±1 dB @ 100 W	±1 dB @ 100 W	±1 dB @ 50 W	
Required AC Power All Units: 120/208 VAC 10% 3Ø (Y) 50-60 Hz 10%					
SYSTEM CONTROLLER:					
Model No.	<u>363/488</u>				
Voltmeter Accuracy	±5% F.S.				
Ammeter Accuracy	±5% F.S.				
Sampling Accuracy	25-1000 MHz -50 dBc ±2 dB; sloping to -66 dBc ±5 dB at 2 MHz				
Unit Insertion Loss	2 dB max				
Input Power	120/208 VAC 10% 3Ø (Y) 50-60 Hz 10%				

MAXIMUM SYSTEM POWER OUTPUT

Serial No. _____

363/30 Amplifier with 363/488 Filter:

<u>Frequency</u>	<u>Maximum System Output</u>
2 MHz	_____ Watts
3.44 MHz	_____ Watts
5.90 MHz	_____ Watts
10.14 MHz	_____ Watts
17.42 MHz	_____ Watts
30.0 MHz	_____ Watts

363/150 Amplifier with 363/488 Filter:

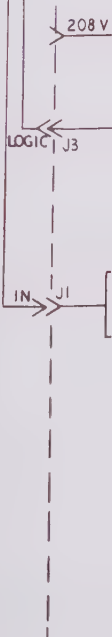
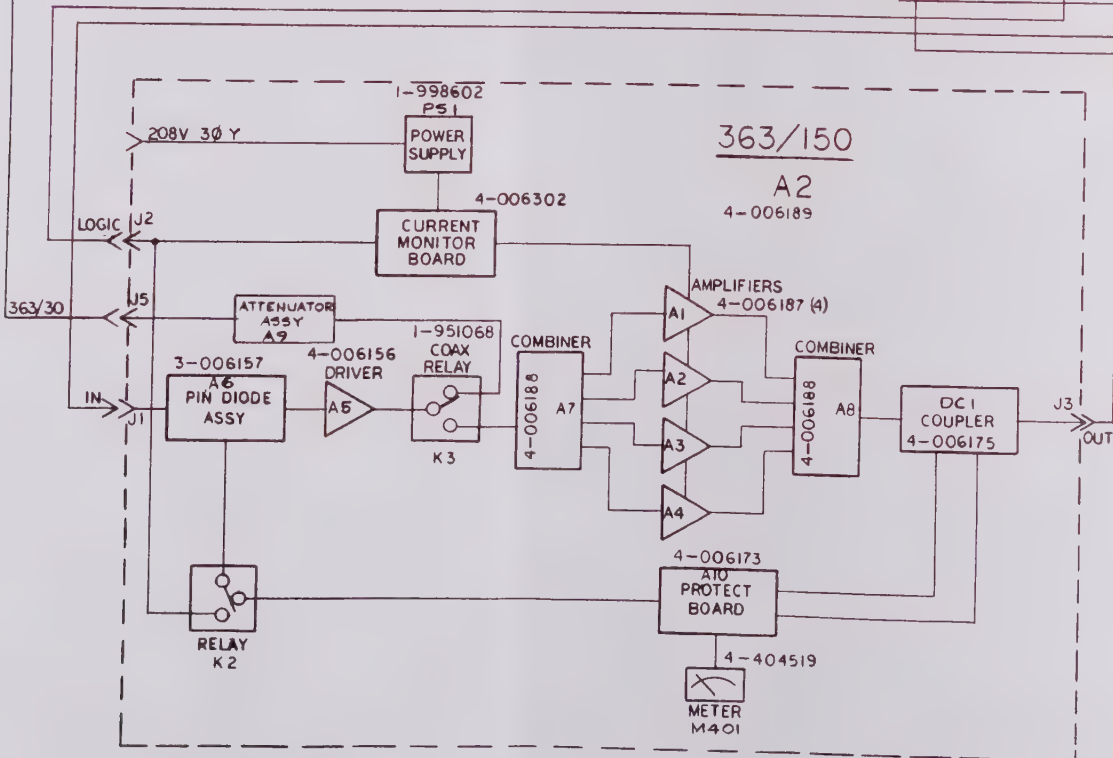
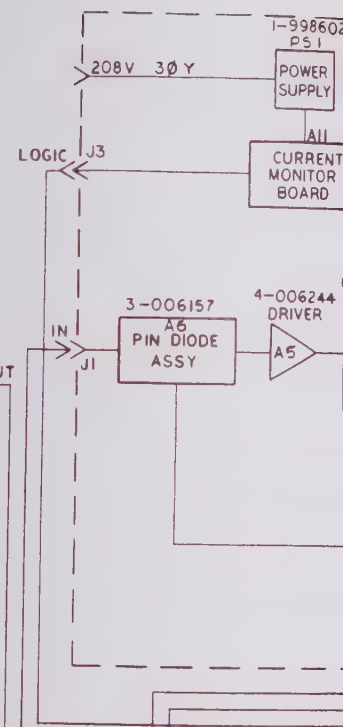
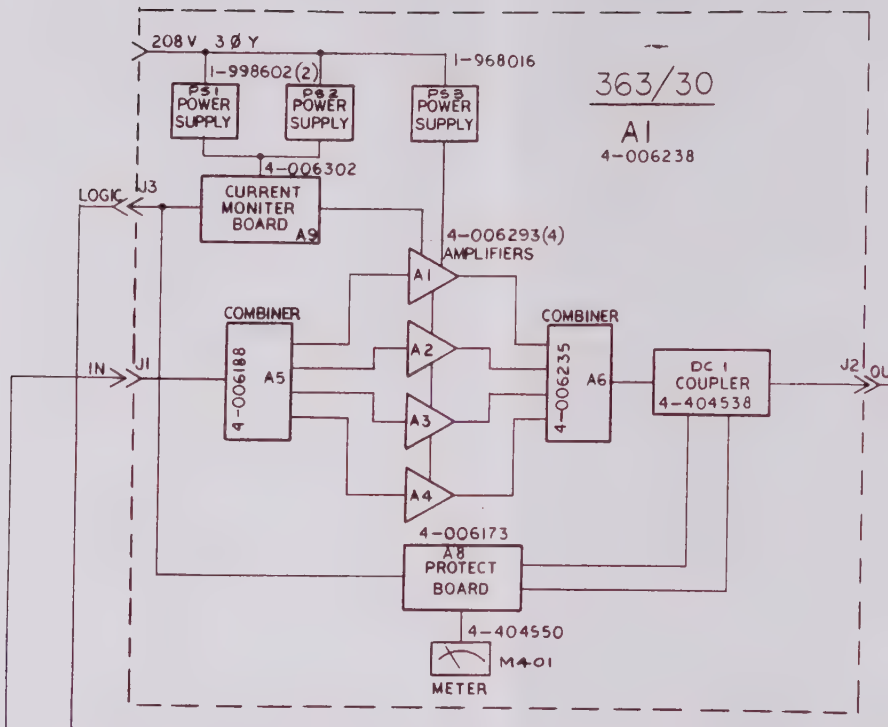
<u>Frequency</u>	<u>Maximum System Output</u>
30 MHz	_____ Watts
51.3 MHz	_____ Watts
87.7 MHz	_____ Watts
150 MHz	_____ Watts

363/500 Amplifier with 363/488 Filter:

<u>Frequency</u>	<u>Maximum System Output</u>
150 MHz	_____ Watts
225 MHz	_____ Watts
337.5 MHz	_____ Watts
500 MHz	_____ Watts

363/1000 Amplifier with 363/488 Filter:

<u>Frequency</u>	<u>Maximum System Output</u>
500 MHz	_____ Watts
725 MHz	_____ Watts
1000 MHz	_____ Watts



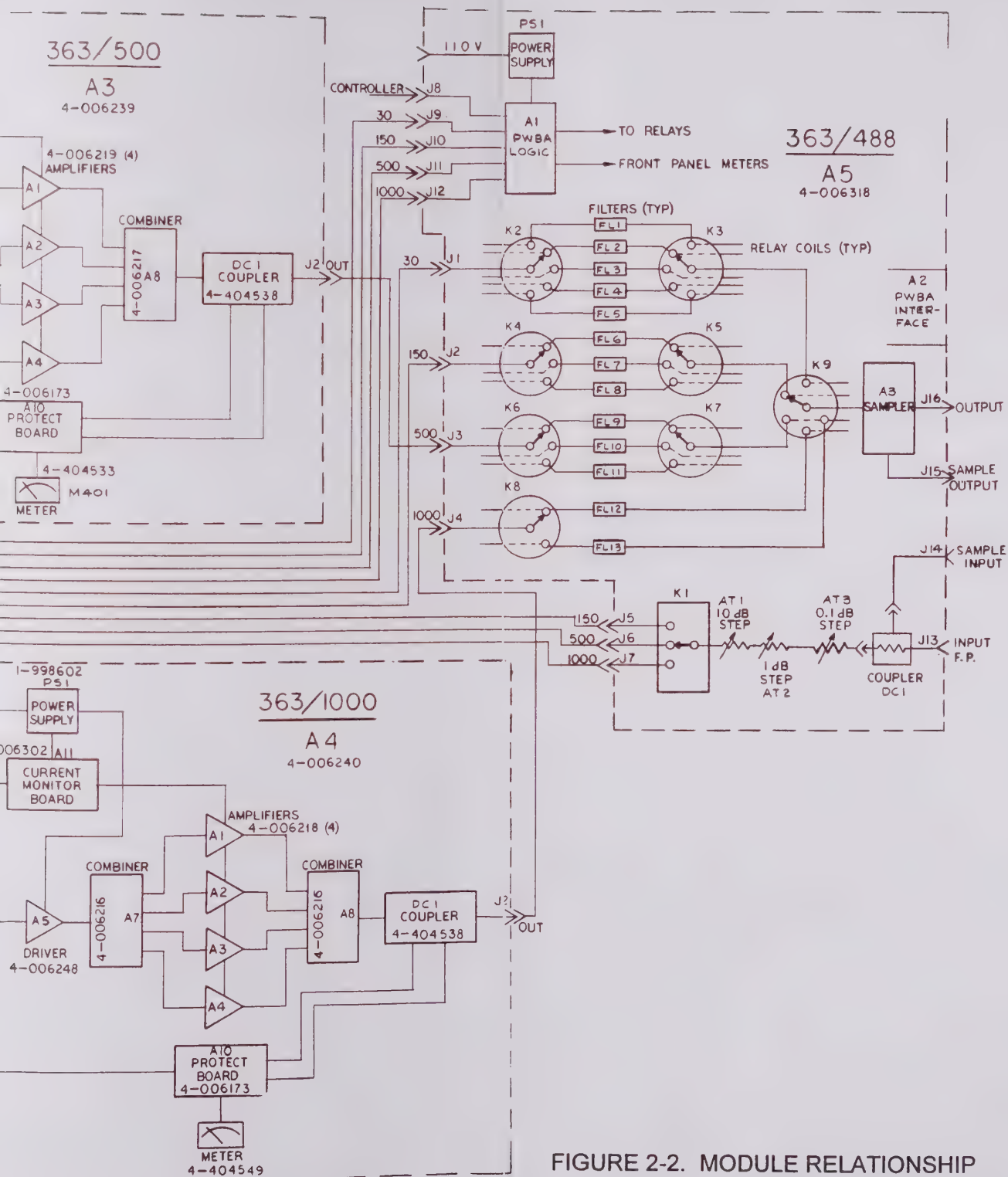


FIGURE 2-2. MODULE RELATIONSHIP OF 363/800 SYSTEM

SECTION 3.0

THEORY OF OPERATION

SECTION 3.0

THEORY OF OPERATION

3.0 THEORY OF OPERATION

3.1 Introduction

This section includes functional descriptions of the 363/800 modules. These functional descriptions are intended for use by operating and maintenance personnel for the 363/800 system.

The 363/800 system provides linear amplification of low-level continuous-wave RF signals for a high power output of 100 to 800 watts, depending on the frequency of the signal (Figure 3-1). None of the amplifiers requires any tuning. The operating frequency range is from 2 to 1000 MHz.

3.2 363/150, 363/500, 363/1000 Amplifiers

The broad band amplifiers consist of a power supply module, a driver module, four output modules, two power combiner/splitters, a directional detector, a current monitor, a metering/protection circuit board, and a pin diode module. Figure 3-2 shows the functional relationship of these modules.

The driver module provides the majority of the amplification with the input power being less than 1 mW for approximately one fourth of the total amplifier output. The remaining power is obtained by connecting four output modules, similar in design to the output stage of the driver, together by the use of combiner/splitters. The output is sampled by a dual directional coupler to provide a DC voltage proportional to forward and reflected power for the front panel meter and to operate the VSWR protective circuitry.

The metering/protection circuit buffers the dual-directional coupler output so that different circuit loading (different meter ranges, calibration settings, etc.) will not cause the coupler output to change. The forward and reflected power is summed and compared with a set reference to establish a safe output operating area. If the output load is a low VSWR (little reflected power), the amplifier will be allowed to deliver its maximum power. However, if the load has a moderate to high VSWR, the amplifier is allowed to deliver less than its maximum power. As the VSWR increases, the available output power decreases until the point where the amplifier will safely drive into an infinite VSWR. The points are adjustable by six potentiometers: three control the break points and three control the slope between the break points. These controls allow ample adjustment for different amplifier models and applications. The pin diode module provides the method for limiting the output power by attenuating the level under the above conditions. To lessen the possibility of damage by sudden high VSWR (for example, a cable failure), a high speed (approximately 10 microseconds) comparator is used to sense this condition and set the pin diode module at its maximum attenuation level for approximately 1 millisecond, which allows the lower speed protective loop time to react to the overload condition.

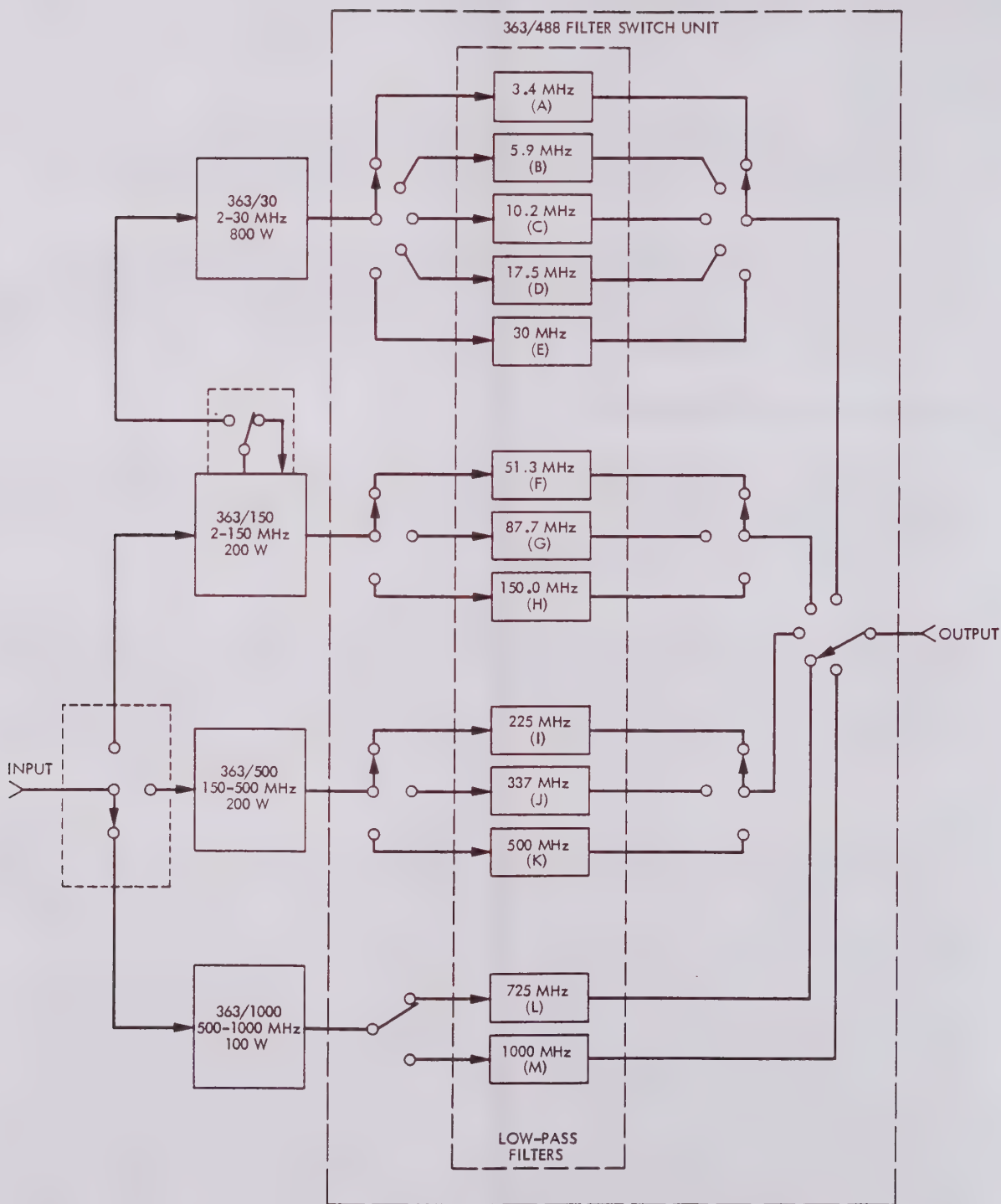
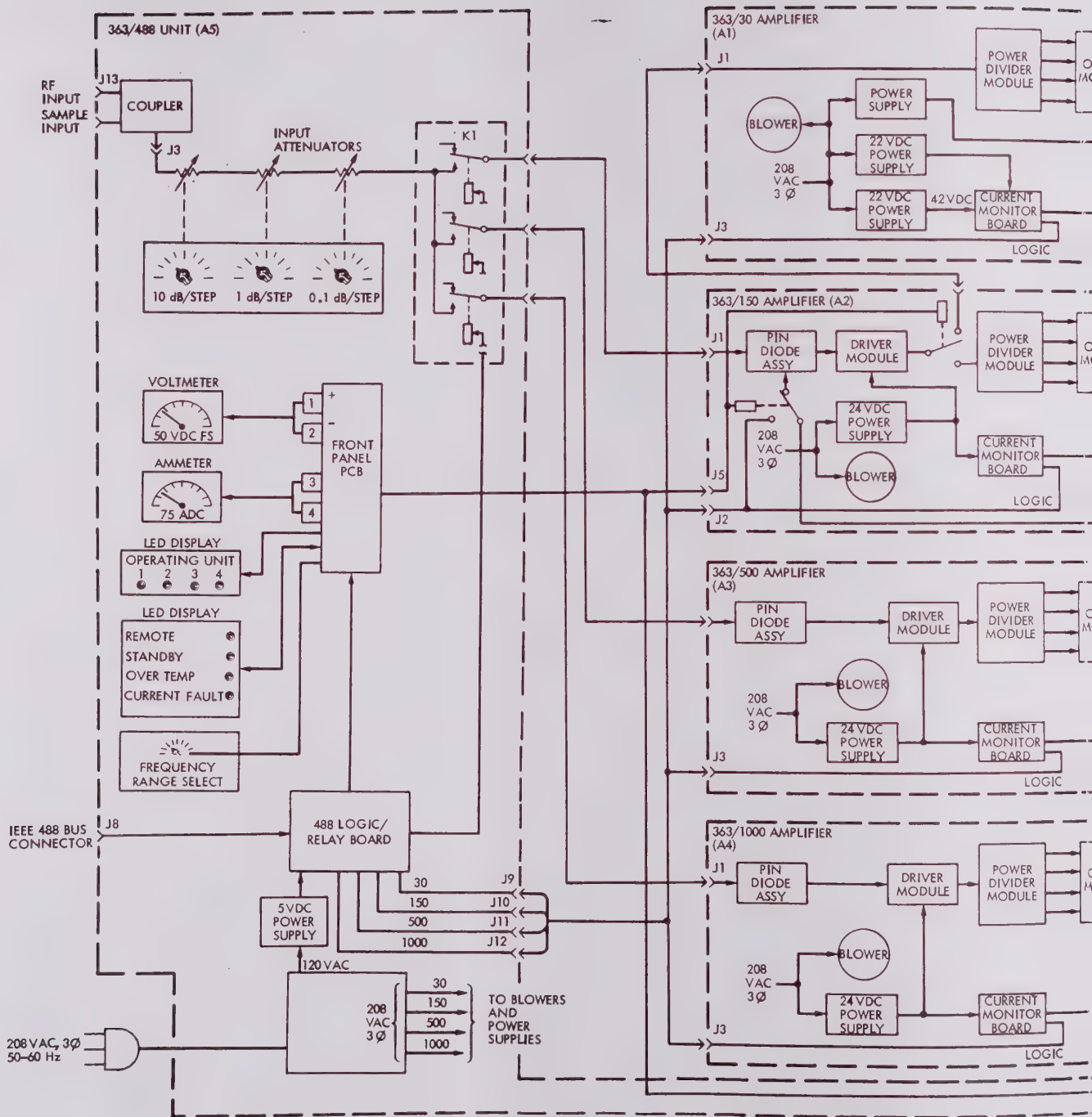


Figure 3-1. Simplified Block Diagram of 363/800 System



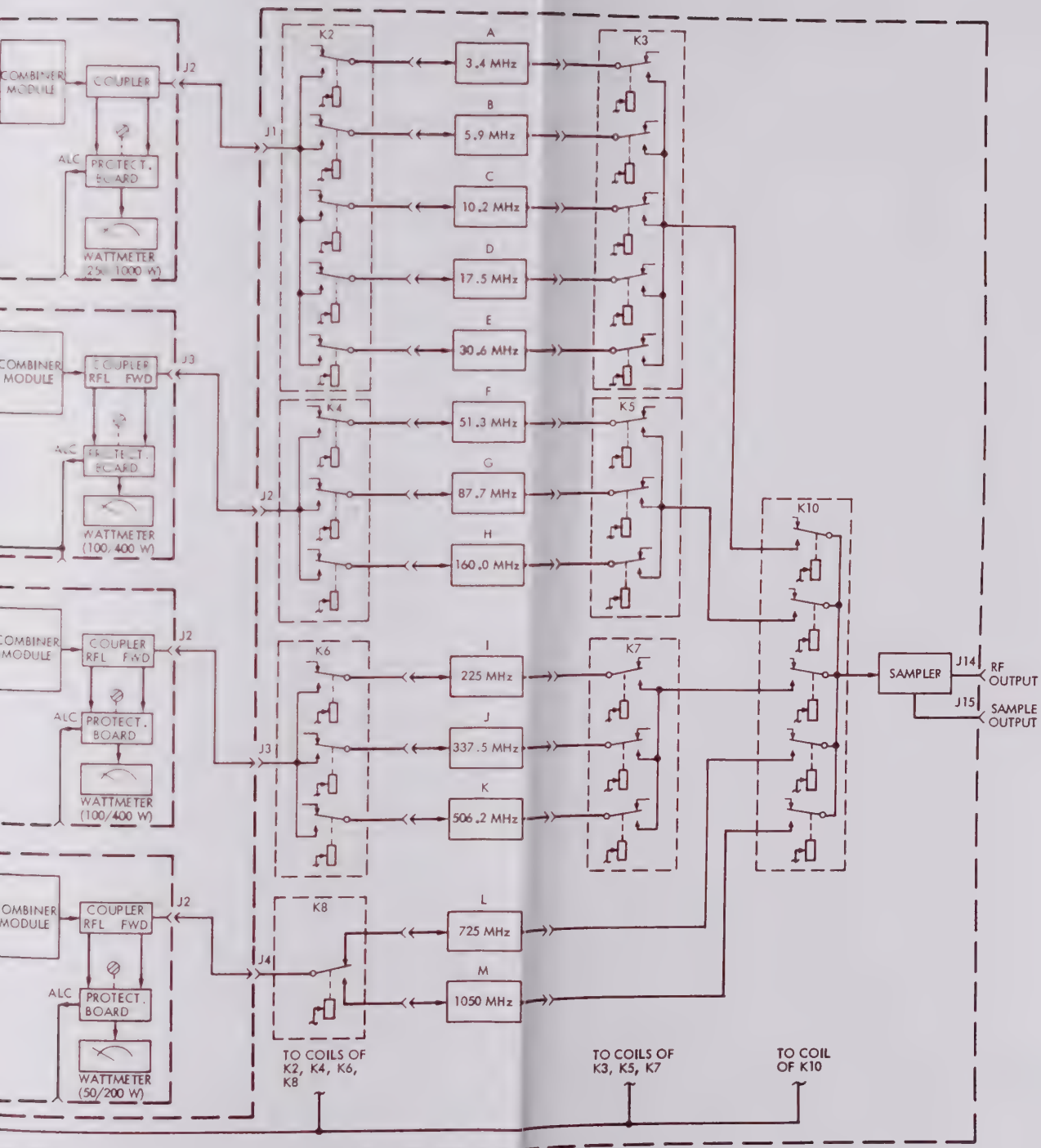


Figure 3-2. 363/800 Wattmeter Calibration System Functional Block Diagram

Additional amplifier protection is provided by the current monitor circuit board. The heart of this board is three differential current switches. They are connected in an arrangement to compare each module current with another module and to compare two pairs of modules against each other. If the current drain of one module is different from its pair by 25%, the differential relay will close and shut the power supply down and signal to the 363/488 system controller a current fault indication. The reasoning behind this is that a RF module failure almost always causes a change in its direct current consumption (usually lower), so comparing module currents is a convenient way to sense a failed module, shut the system down, and alert the operator. Although operation with a failed module is technically feasible, AMT recommends immediate repair to prevent possible damage to additional modules. If it is imperative to continue operation with a failed module, there is a defeat switch located in the amplifier. The current fault indicator will still indicate a problem, but the system will operate at reduced power. Another function of the current monitor board is to interface between the 363/488 switch box and the amplifier circuitry. Logic signals to turn on an amplifier are routed to this circuit board through a 14-conductor, ribbon cable connecting each amplifier to the 363/488. Analog signals for the amplifier voltage and current and logic levels for over-temperature and current fault indication are processed by the current monitor board and are routed back to the 363/488 for indication to the operator.

3.3 363/30 Amplifier

The 363/30 amplifier system is somewhat different. There is no driver module and in its place a second 24-volt power supply had been added to supply the additional power for the amplifier's 800 watt output level. The four output modules, combiners/splitters, directional coupler, metering/protection circuit board, and the current monitor circuit are functionally equivalent to the three preceding amplifiers. The driver module from the 363/150 is utilized as the driver for the 363/30. A logic signal from the 363/488 switch box to a coaxial relay located in the 363/150 diverts the output of the 363/150 driver to the input of the 363/30 when bands A through E are selected. When band F, G, or H is selected, the coaxial relay reconnects the output of the 363/150 driver to its output modules for operation from 30 MHz to 150 MHz.

3.4 Protection/Metering Board

A protection/metering board provides protection in each of the four power amplifiers when subjected to high VSWR at high levels. This is accomplished by using the output voltage of the amplifier directional coupler to provide forward and reflected power information. The circuit is designed to allow a predetermined amount of forward power to be developed by the amplifier under different load conditions. If the load has a low VSWR, the protection circuit will allow the amplifier to develop more power than if the load has a high VSWR.

When a power level exceeds the limits set by the protection board, the current to the pin diode (attenuator) is reduced, causing a reduction in the input signal to the amplifier limiting the output of the amplifier. When this occurs, the **over load** indicator (LED) will light. This circuit also provides protection in the event the operator selects the wrong amplifier/filter combination for the input frequency (out of band operation). The input buffer amplifiers, IC U401 A and B, provide buffered voltages for the front panel power meter and ALC output connector.

3.5 363/488 System Controller

The 363/488 system controller contains 13 filters connected by coaxial relays. The relays form a switching matrix to allow one input and one output connector for the complete system. Individual amplifiers are connected to the 363/488 by rear panel connectors. The relays are driven by the logic printed circuit board. For band selection, the information may be entered by a 13-position rotary switch or by a controller using the IEEE 488 bus input on the rear panel of the instrument.

The logic printed circuit board also provides a sequence of events when bands are changed. First, all inputs, amplifier voltages, and outputs are disconnected. Next, the selected filter is connected to the appropriate amplifier and output connector. Then the power supply voltage of the selected amplifier is turned on. Finally, the input is connected to the selected amplifier. This procedure prevents switching the filters, amplifiers, and relays with RF power applied. This sequence takes place whether the bands are selected manually or from the 488 bus.

The 363/488 generates logic signals to control the power supplies of the amplifiers so as to allow only the amplifier in use to consume current. Logic signals from the amplifiers are processed by the logic board and are directed to the front panel to supply over-temperature and current fault indications. Analog signals which represent amplifier voltage and current are routed directly to the front panel two meter circuits. Information as to which amplifier is in use and system stand-by is generated by the logic circuit board. These logic levels are also routed to the front panel indicators. The band selection switch is a BCD encoding type. Its four output lines are routed to the logic board to select the desired band during manual operation.

Power for the logic board is obtained by a 5 volt power supply, internal to the 363/488. Power for the relays is obtained from the amplifier in use. Steering diodes direct the current from the active amplifier to the relay power bus.

SECTION 4.0

OPERATION

4.0 OPERATION

4.1 Introduction

This section contains complete operating instructions for the Wattmeter Calibration System identified as AMT Model 363/800. Instructions contained in this section are intended for use by personnel involved in the actual operation of the subject equipment. The Model 363/800 can be operated in either of two ways: Operation can be controlled locally at the equipment by manipulation of front-panel controls, or operation can be controlled remotely by computer or other suitable programmable controllers. In either case, the operator is required to perform various preliminary procedures before operation can begin. Accordingly, the scope of this section includes instructions for use in either application.

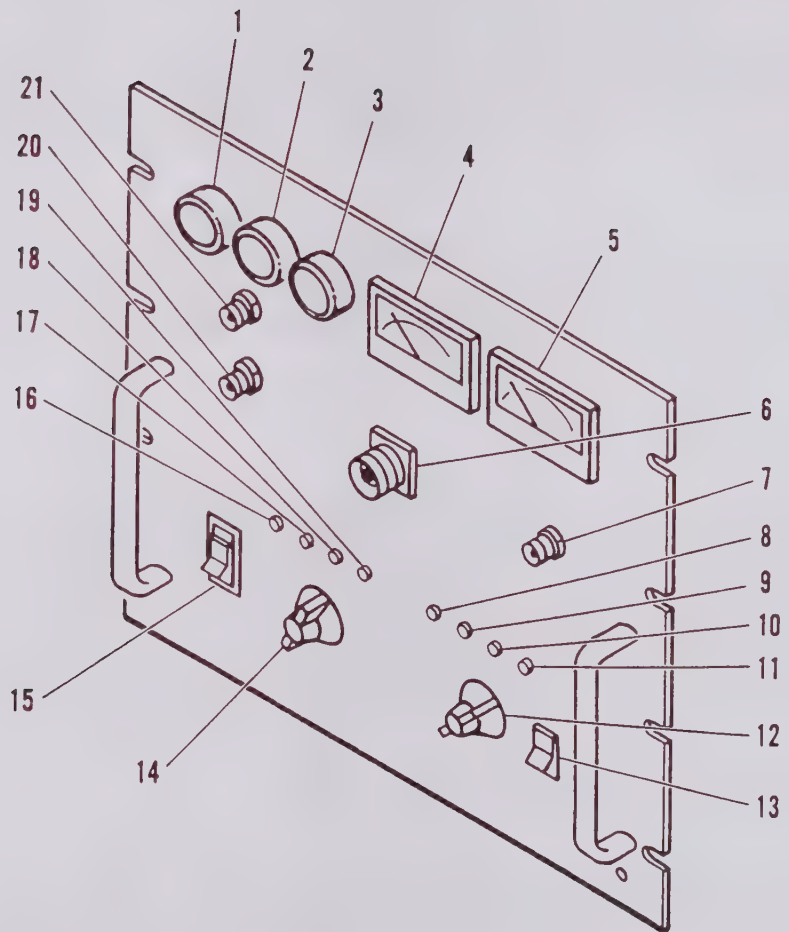
Operation in either application requires a suitable RF signal source and a compatible output load for the frequency and power level of the system output. Operation from a remote controller requires addition of a 24-conductor interface cable and controller with IEEE-488 bus interface compatibility.

4.2 Controller/Amplifier Panels

The Model 363/800 comprises one system controller (Model 363/488, subassembly A5) and four linear wide band RF power amplifier assemblies (Models 363/30, 363/150, 363/500 and 363/1000). Procedures throughout this section refer to the amplifier control locations simply by their respective model numbers. As an orientation reference, Figure 1-1 shows the locations of each of the major subassemblies; operators unfamiliar with the subject equipment are advised to learn the locations and characteristics of each of these subassemblies before proceeding with this section.

4.3 Controls and Indicators (Figures 4-1 and 4-2)

Primary controls and indicators required to operate the Wattmeter Calibration System are located on the front panels of the equipment. A rear-mounted secondary control, the unit address switch, is set at the beginning of operations during installation, but requires no further operator attention unless the unit address (necessary for remote operation) must be changed. Figure 4-1 illustrates all front-panel controls and indicators found on the 363/488 system controller; Table 4-1 is cross-referenced to Figure 4-1 and provides a functional description of these controls. Figure 4-2 illustrates all front-panel controls and indicators found on each of the four amplifier assemblies (the view illustrated is typical for all four); Table 4-2 is cross-referenced to Figure 4-2 and provides a functional description of these controls. It is necessary that operators inexperienced with the subject equipment become familiar with these controls and understand their functions before applying power to the Wattmeter Calibration System.



NOTE: Call-out numbers are cross-reference index numbers for descriptions found in Table 4-1.

Figure 4-1. Operator Controls, Indicators, and Connectors: 363/488 Controller Panel

Table 4-1. Operator Controls, Indicators, and Connectors, 363/488 Controller
(Sheet 1 of 4)

Index No. (Fig. 4-1)	Control, Indicator or Connector Name	Function
1	10 dB (Input Attenuation)	Eight-position rotary switch: Controls attenuation of RF input from 0 dB to -70 dB in 10 dB steps; attenuated signal is input to selected amplifier. Cascaded with attenuators of items 2 and 3.
2	1 dB	Eleven-position rotary switch: Controls attenuation of RF input from 0 dB to -10 dB in 1 dB steps; attenuated signal is input to selected amplifier.
3	0.1 dB	Eleven-position rotary switch: Controls attenuation of RF input from 0 dB to -1 dB in 0.1 dB steps; attenuated signal is input to selected amplifier.
4	No placarding (DC voltmeter)	Direct current voltmeter with ten-volt graduations to 50 volts at full scale. Measures voltage supplied to 1 driver and 4 output modules of selected amplifier assembly. Meter measures voltage of amplifier selected by meter select knob (item 12). (363/30 uses 363/150 driver and therefore driver and output module voltages must be measured separately for bands A through E).
5	No placarding (DC ammeter)	Direct-current ammeter with 15-ampere graduations to 75 amperes at full scale. Measures current being drawn by 1 driver and 4 output modules of selected amplifier assembly. Meter measures current drawn by amplifier selected by meter select knob (item 12). (363/30 uses 363/150 driver and therefore driver and output module currents must be measured separately for bands A through E).
6	RF Output	A type GR900 hermaphroditic connector (i.e., the mating interface connector is also a type GR900 connector): Calibrated RF output connector for connection to wattmeter being tested or being calibrated (50-ohm).

Table 4-1. Operator Controls, Indicators, and Connectors: 363/488 Controller
(Sheet 2 of 4)

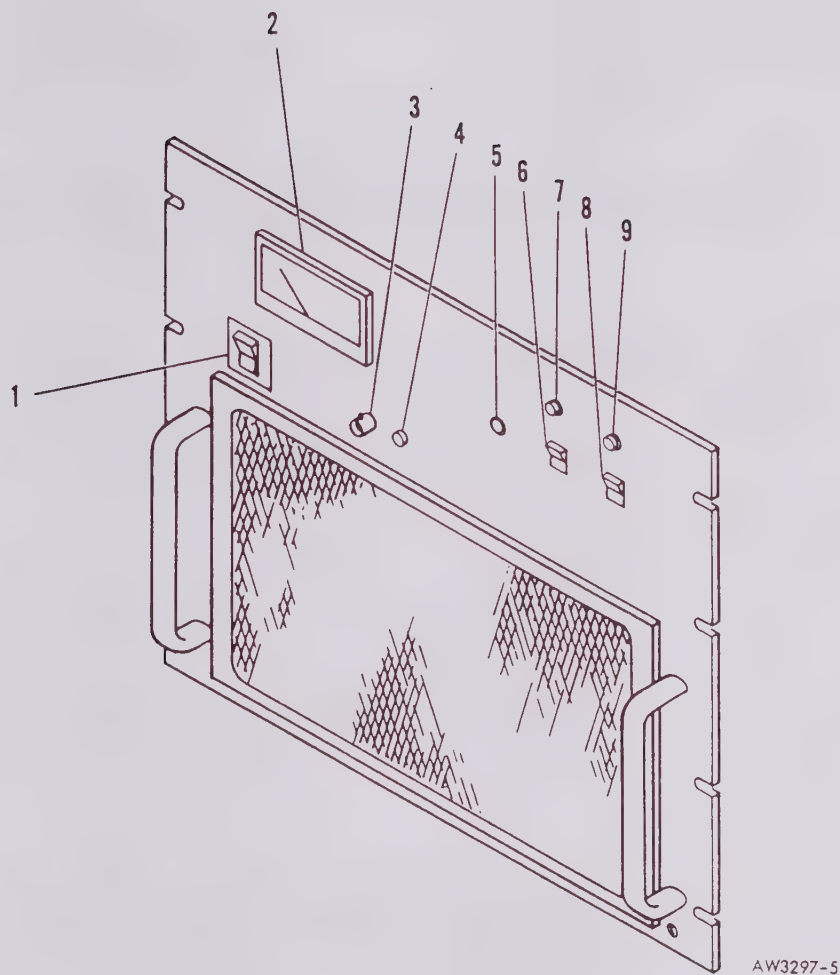
Index No. (Fig. 4-1)	Control, Indicator or Connector Name	Function
7	Sample Output	Type N coaxial connector: Samples RF signal produced at RF Output (item 6) and produces an RF signal that is nominally -50 dB output.
8	363/30	LED indicator (red): When lighted, indicates that the 363/30 amplifier is selected for operation (remotely by the 488 bus, or locally with the panel switch, item 14). This indicator lights at selections of bands A through E.
9	363/150	LED indicator (red): Operates in the same way as item 8, except that when lighted amplifier 363/150 is selected and operating (during selections of any of bands F, G or H and when 363/150 is used as a driver of bands A through E).
10	363/500	LED indicator (red): Operates the same as item 8, except that amplifier 363/500 is active when indicator is lighted (during selection of bands I, J, or K).
11	363/1000	LED indicator (red): Operates the same as item 8, except that amplifier 363/1000 is selected and active when indicator is lighted (i.e., during selection of bands L or M).
12	Meter Select (positions 363/30, 363/150 363/500, and 363/1000)	Four-position rotary switch: Used to select inputs to meters for voltage and current measurements of selected amplifiers. Each position is placarded with amplifier Model No. that will be measured at that position.

Table 4-1. Operator Controls, Indicators, and Connectors: 363/488 Controller
(Sheet 3 of 4)

Index No. (Fig. 4-1)	Control, Indicator or Connector Name	Function																																																								
13	Operate/ standby	Two-position toggle switch: When this switch is set to standby position, normal RF amplification is inhibited. When switch is set to operate position, normal powered operation is enabled (provided switch is first set to standby before being set to operate). When unit is in standby mode, red standby indicator lights.																																																								
14	Band/ Frequency/ Megahertz	Thirteen-position switch: Functional in local mode only. Each of 13 positions selects an amplifier and an appropriate filter for each band of frequencies, as follows: <table><tr><th><u>Band</u></th><th><u>Frequency Range</u></th><th><u>Amplifier</u></th><th><u>Filter</u></th></tr><tr><td>A</td><td>2 - 3.4 MHz</td><td>363/30</td><td>A</td></tr><tr><td>B</td><td>3.4 - 5.9 MHz</td><td>363/30</td><td>B</td></tr><tr><td>C</td><td>5.9 - 10.2 MHz</td><td>363/30</td><td>C</td></tr><tr><td>D</td><td>10.2 - 17.5 MHz</td><td>363/30</td><td>D</td></tr><tr><td>E</td><td>17.5 - 30.0 MHz</td><td>363/30</td><td>E</td></tr><tr><td>F</td><td>30.0 - 51.3 MHz</td><td>363/150</td><td>F</td></tr><tr><td>G</td><td>51.3 - 87.7 MHz</td><td>363/150</td><td>G</td></tr><tr><td>H</td><td>87.7 - 150 MHz</td><td>363/150</td><td>H</td></tr><tr><td>I</td><td>150 - 225 MHz</td><td>363/500</td><td>I</td></tr><tr><td>J</td><td>225 - 337 MHz</td><td>363/500</td><td>J</td></tr><tr><td>K</td><td>337 - 500 MHz</td><td>363/500</td><td>K</td></tr><tr><td>L</td><td>500 - 725 MHz</td><td>363/1000</td><td>L</td></tr><tr><td>M</td><td>725 - 1000 MHz</td><td>363/1000</td><td>M</td></tr></table>	<u>Band</u>	<u>Frequency Range</u>	<u>Amplifier</u>	<u>Filter</u>	A	2 - 3.4 MHz	363/30	A	B	3.4 - 5.9 MHz	363/30	B	C	5.9 - 10.2 MHz	363/30	C	D	10.2 - 17.5 MHz	363/30	D	E	17.5 - 30.0 MHz	363/30	E	F	30.0 - 51.3 MHz	363/150	F	G	51.3 - 87.7 MHz	363/150	G	H	87.7 - 150 MHz	363/150	H	I	150 - 225 MHz	363/500	I	J	225 - 337 MHz	363/500	J	K	337 - 500 MHz	363/500	K	L	500 - 725 MHz	363/1000	L	M	725 - 1000 MHz	363/1000	M
<u>Band</u>	<u>Frequency Range</u>	<u>Amplifier</u>	<u>Filter</u>																																																							
A	2 - 3.4 MHz	363/30	A																																																							
B	3.4 - 5.9 MHz	363/30	B																																																							
C	5.9 - 10.2 MHz	363/30	C																																																							
D	10.2 - 17.5 MHz	363/30	D																																																							
E	17.5 - 30.0 MHz	363/30	E																																																							
F	30.0 - 51.3 MHz	363/150	F																																																							
G	51.3 - 87.7 MHz	363/150	G																																																							
H	87.7 - 150 MHz	363/150	H																																																							
I	150 - 225 MHz	363/500	I																																																							
J	225 - 337 MHz	363/500	J																																																							
K	337 - 500 MHz	363/500	K																																																							
L	500 - 725 MHz	363/1000	L																																																							
M	725 - 1000 MHz	363/1000	M																																																							
15	Power/On/ Off	Two-position toggle switch: Primary power switch for energizing the overall 363/488 controller.																																																								

Table 4-1. Operator Controls, Indicators, and Connectors: 363/488 Controller
(Sheet 4 of 4)

Index No. (Fig. 4-1)	Control, Indicator or Connector Name	Function
16	Remote	LED indicator (red): When lighted, indicates that system is subject to operation from a remote controller (via the external 488-bus). Remote operation is selected by the controller which will disable the front panel band and operate/standby switches.
17	Standby	LED indicator (red): When lighted, indicates that system is powered but operation is inhibited (operate/standby switch, item 13, is in standby).
18	Current Fault	LED indicator (red): When lighted, indicates that there is a significant current imbalance in one or more of the four output modules of the selected amplifier (conduct troubleshooting procedure).
19	Over Temperature	LED indicator (red): When lighted, indicates that temperature of the driver or output modules of the selected amplifier has tripped an automatic resettable thermal breaker. Amplifier operation will be inhibited until temperature reaches safe limits. If over temperature indicator continues to light, refer to troubleshooting procedure.
20	RF Input/ 1 V Max	Type N RF connector: Coaxial signal-input connector for driving the system. Read caution note before connecting input.
21	Sample Input	Type N RF connector: Connects to internal RF coupler for sampling signal source driving the system (i.e., item 20 input). Used for monitoring input frequency with counter.



AW3297-5

(Typical Front Panel View for Models 363/30, 363/150, 363/500, 363/1000)

NOTE: Call-out numbers are cross-reference index numbers for descriptions found in Table 4-2.

Figure 4-2. Operator Controls, Indicators, and Connectors: RF Amplifier Panels

Table 4-2. Operator Controls, Indicators, and Connectors: Amplifier Panel
(Sheet 1 of 2)

Index No. (Fig. 4-2)	Control, Indicator or Connector Name	Function															
1	Power/On	Two-position toggle circuit breaker switch: Used to control power to individual amplifier assemblies; power to amplifier assemblies is all controlled separately.															
2	No panel placarding (wattmeter)	RF power meter scaled in watts: High and low scales are selected by panel switch (item 6) and measure either forward or reflected power into 363/488 controller as selected by panel switch (item 8). Full scale ranges depend upon the amplifier being monitored, as follows: <table> <tr> <th>Model</th><th>Low Full Scale</th><th>High Full Scale</th></tr> <tr> <td>363/30</td><td>250 W</td><td>1000 W</td></tr> <tr> <td>363/150</td><td>100 W</td><td>400 W</td></tr> <tr> <td>363/500</td><td>100 W</td><td>400 W</td></tr> <tr> <td>363/1000</td><td>50 W</td><td>200 W</td></tr> </table>	Model	Low Full Scale	High Full Scale	363/30	250 W	1000 W	363/150	100 W	400 W	363/500	100 W	400 W	363/1000	50 W	200 W
Model	Low Full Scale	High Full Scale															
363/30	250 W	1000 W															
363/150	100 W	400 W															
363/500	100 W	400 W															
363/1000	50 W	200 W															
3	ALC Out	Type BNC connector: Used for supplying the forward voltage produced by the directional coupler, for external leveling purposes. Measured DC voltage is an analog of the output power level.															
4	ALC Out Adj	Trim potentiometer, screwdriver adjustment: Used to adjust DC voltage scaling of ALC measured at panel connector (item 3).															
5	Over Load	LED indicator (red): When lighted, indicates that amplifier is being driven to its safe limits of operation.															

Table 4-2. Operator Controls, Indicators, and Connectors: Amplifier Panel
(Sheet 2 of 2)

Index No. (fig. 4-2)	Control, Indicator or Connector Name	Function
6	High/Low	Two-position toggle switch: Used to set full-scale range of wattmeter (refer to item 2) to either high or low wattage scale (High = 4 x low).
7	High (Meter CAL)	Trim potentiometer, screwdriver adjustment: Used to adjust calibration of the high scale of the wattmeter (item 2).
8	FWD/RFL	Two-position toggle switch: Used to select wattmeter (item 2) input to read either forward (FWD) RF power or reflected (RFL) RF power as measured at the amplifier output.
9	Low (Meter CAL)	Trim potentiometer, screwdriver adjustment: Used to adjust calibration of the low scale of the wattmeter (item 2).

4.4 System Interface Cabling

Pre-operation check out after the initial installation should include a check of all cabling between system subassemblies to verify that each cable is properly routed and each cable connector is seated and tightened snugly with its respective chassis connectors. This preliminary check may be performed by visually inspecting the cables from the back of the system cabinet and using Figure 4-3 as a check reference. Note that the unit address select switch (A5S1) is shown in this figure. If the unit is to be operated remotely, set the digital dip switch to match the 5-bit binary address code that the remote controller will use to communicate with this unit. (Use switch 1 as the least significant bit and set each switch to **ON** for a respective digital one -- for each binary zero leave the switch **OFF**).

4.5 Operator Safety Precautions

Because of potential hazards to personnel and to equipment, operators are advised to be aware of such dangers and of the steps necessary to prevent their occurrence.

Warnings describe conditions that, if not avoided, are lethal or injurious to personnel;

Cautions describe conditions that, if not avoided, can damage equipment.

WARNING

The Wattmeter Calibration System can operate at frequencies up to 1000 megahertz and at power levels up to 800 watts, which together can cause lethal or severe radiation injury if recommended safety precautions are not strictly observed. (The human eye is particularly susceptible to developing cataracts when subjected to high-level RF radiation). Accordingly, personnel are warned not to stand near any active antenna or other radiating element. Do not disconnect the system RF output coaxial cable unless the system has first been placed in the STANDBY mode. Similarly, hazardous RF voltages exist at the output stage of any active amplifier assembly, which should not be accessed unless the system is either in the STANDBY mode or primary power is removed.

Personnel are warned that although no radiation hazard exists with the primary power line, physical contact with such voltages can be lethal. Primary line voltage (approximately 300 volts peak) exists in all four amplifier assemblies, whether active or not, and in the system controller.

CAUTION

Do not disconnect any coaxial cable in series with, or connected to, the RF INPUT panel connector unless the system is first placed in the STANDBY mode; failure to observe this caution can cause generation of transient spikes at the input, which (when amplified) can exceed rated power levels of both the system and the load under test, damaging both.

Do not disconnect any coaxial cable in series with, or connected to, the RF OUTPUT panel connector unless the system is placed in the STANDBY mode; failure to observe this caution can cause a load mismatch and excessive VSWR, which can cause the amplifier power ratings to be exceeded and cause equipment damage.

CAUTION

Prevent system overheating by ensuring a minimum clearance of 12 inches exists behind the system enclosure. Ensure that both air inlets and exhaust fans are unobstructed.

Always ensure that the test load being driven is of the proper impedance (50 ohms) and adequate power rating, and is only being tested within its specified frequency range. Failure to observe this caution can cause damage to both the system and the test load.

4.6 Pre-Operation Preparation

Following verification of system cabling, and before energizing the system, procedures require that the following preparations be made (ensure **power switch off**):

- a. Leveling Pads. Adjust each of the four leveling pads located at each corner of the 363/800 cabinet so that the weight is distributed evenly and the system is level and stabilized.
- b. Signal Source. Connect a signal source to the RF/INPUT connector on the system controller front panel. Depending upon the maximum output of the signal source, it is strongly recommended that a fixed attenuator be placed in series between the signal source and the 363/800 system RF INPUT, so that the maximum input power to the system cannot exceed 10 milliwatts (to prevent inadvertently overdriving the system). Any signal source used should have the stability and setability necessary to prevent frequency drifting and prevent operation outside of the selected band. Frequency synthesizers and most signal generators meet these requirements. Other sources than these may be used, but careful frequency monitoring is necessary to ensure specified operation. Connect and adjust the signal source before energizing any amplifier.
- c. Output Load. The only requirement for the load or device under test is that its power rating must not be exceeded and that its nominal impedance must be 50 ohms. Connect the load before energizing any amplifier.
- d. Initial Control Settings. Before energizing the 363/800 system, set all panel controls as follows (unless test requires other settings):

EACH AMPLIFIER ASSY

Switch	Position
High/Low	High
FWD/RFL	FWD

SYSTEM CONTROLLER

Switch	Position
Operate/Standby	Standby*
Band Switch	Band of operation (refer to Table 4-1, index 14)
Meter Select	Amplifier of interest
Input Attenuators	0 dB/0 dB/0 dB (minimum attenuation)

* Operator Note: The **Operate/Standby** switch must be initially set to the **Standby** position (when the system controller is powered up) before switching to the **Operate** position. Power up while the switch is in the **Operate** position keeps the system controller in the standby mode until the switch is first set to **Standby**, then set to **Operate**. This prevents the system from being powered up in the operate mode and forces the operator to make the **Standby-to-Operate** transition, which prompts a check of the source, the band selection, and the output load before operating at high power.

e. Source Adjustment.

1. Turn on signal source power.
2. Adjust operating frequency (must be compatible with selected band).
3. Adjust RF output level of signal source to -20 dBm.

4.7 OPERATION PROCEDURES

The turn-on sequence is not critical, but it is recommended that the 363/488 system controller be energized first, followed by energizing the amplifier assemblies. The control logic is designed so that the amplifiers must receive a control signal (from the 363/488 system controller) before their respective internal power supplies will turn on. If the amplifier assemblies are turned on before the system controller is turned on, those amplifiers will stay in an idle state until the system controller is turned on. Since the amplifier assemblies operate independently of one another (with the exception of the 363/30, which must use the 363/150 as a driver), unused amplifier assemblies can remain turned off.

a. Procedures

1. Set system controller **Power on/off** switch to **on**.
2. Set selected amplifier **power** switch to **on** (system is energized, but it is in **standby**).
3. Set system controller **operate/standby** switch to **operate** position.
4. Monitor selected amplifier forward (FWD) and reflected (RFL) power while slowly increasing input drive level until output power is at desired level (meter sensitivity may be increased by a factor of 4 by switching the amplifier **High/Low** switch to **Low** position). Output power level may be adjusted by varying the signal source output level or by adjusting the three amplifier **Input Attenuation** knobs.

Note: The reflected power reading does not necessarily mean the load has a poor VSWR. Some of the reflected power is the result of the characteristic VSWR of the 363/488 system controller interconnects. Another source contributing to the VSWR reading is the reflected harmonic energy of the amplifiers. Reflected power up to 10 percent of the forward power is normal for the Models 363/150, 363/500, and the 363/1000 amplifiers. The Model 363/30 will normally read up to 25 percent reflected power because of its class A/B design, which produces a higher harmonic content. Excessive VSWR, caused by a poor load, causes the amplifiers' output to be reduced by the protective circuitry and causes the amplifier **Overload** indicator to light (a signal to the operator). The **Overload** indicator also lights if the amplifier is being driven beyond its safe output power level.

5. Rotate the 363/488 System Controller **Meter Select** switch to any amplifier position to monitor the amplifier operating conditions with the voltmeter and ammeter. However, meter readings can vary ± 20 percent from the typical readings and still be within normal operating ranges for the system. The current reading will vary during system warm up and when the driving signal is first turned on. The Model 363/30 amplifier current will vary directly with the RF signal level since it is biased in class A/B. Only a sudden drastic change is indicative of an amplifier fault.

4.8 Operating Indicators

Over Temperature and **Current Fault** indicators (located on the 363/488 System Controller panel) light when temperature or current problems occur. When an over temperature or current fault occurs, the power supply for the affected amplifier is shut down, which is indicated by the absence of voltage or current measured at that amplifier. When an over temperature condition returns within acceptable limits, the power supply automatically turns on and restores operation. However, when a current fault occurs, the power supply is latched off and must be reset by turning the amplifier **Power** switch off for several seconds, after which it is then switched **On** to restore operation. A continuing fault indication suggests a module failure (refer to Section 7, Troubleshooting).

4.9 Changing Frequency

Frequency or band changes are accomplished by setting the 363/488 System Controller **Operate/Standby** switch to the **Standby** position (disables all amplifiers), reducing the RF input power to -20 dBm, changing the signal source to the new frequency, selecting the correct **Band** for the new frequency, returning the **Operate/Standby** switch to the **Operate** position (ensures selected amplifier **Power** switch is **On**), and then increasing the RF input level to produce the desired output power. The reason for reducing the RF power to -20 dBm during frequency change is because the amplifier gain can vary from frequency-to-frequency and from band-to-band, which can otherwise cause unintentional overdrive of the system. To avoid unnecessary overdrive to the amplifiers and possible damage to the device being tested, it is recommended that the input level always be reduced to -20 dBm during any frequency changes.

4.10 Remote 488-Bus Operation

The Model 363/800 Wattmeter Calibration System is designed to provide the operator with the option of remotely switching bands from any IEEE 488 GPIB bus-compatible controller.

The remote programmable device (a programmable calculator, Hewlett-Packard Model HP85 can be used) must be cable-connected to the rear connector (A5J8) of the System Controller Model 363/488 via a 24-conductor cable. When the Model 363/800 is under program control, it is desirable that the companion signal source also be remotely controllable from the same parallel 488 bus to ensure temporary reduction of the RF drive level (to -20 dBm) during frequency changes and to command the frequency changes. (Since the test-operation power level is a subjective choice, intervention by the operator may still be required to make the final adjustment of output power level for each frequency change). The control program must address the 363/800 of choice by the 5-bit code set in the 5-pole address switch which is located at the back of the 363/488 System Controller (see inset A of Figure 4-3). Similarly, the companion signal source must be separately addressed with its own program format. (Since the Model 363/800 and the companion signal source are both party-line connected in parallel to the same 488 bus, along with up to 30 other such equipments, the operator must ensure that no two instruments are set with the same address).

The 363/488 system controller incorporates the basic listener 2 and remote/local 2 functions. A complete list of commands and data format are tabulated in Table 4-3. An example of a simplified program is tabulated in Table 4-4.

The 5-pole address switch at the back of the 363/488 (A5S1) sets the five binary address bits comprising the digits of the decimal number address. Accordingly, the possible addresses that may be used to address any 363/488 range from 00 to 31 (the range of the 5-pole address switch being 00 to 31). The stabel frequency source may be similarly addressed, but must always use an otherwise unassigned, unique number.

The programmable source and the 363/488 should be programmed so that the 363/488 is always addressed first with the latest band selection, followed by addressing the programmable frequency source. When the 363/488 is addressed for a band change, the 363/800 system goes into the standby mode for approximately one second, which allows sufficient time for the frequency source to be addressed, the RF output level to be reduced to -20 dBm, the change of frequency to occur, and for any other instruments to be programmed by the 488 bus.

Table 4-3. Programmable 488 Commands and Data Format

Function	Definition
A. <u>Multi-Line Commands</u>	
1. Listen	(Addressed State)
2. Unlisten	(Unaddressed State)
3. Go to Local (7xx)	(Selected Instruments)
4. Remote (7xx)	(Selected Instruments)
B. <u>Uni-Line Commands</u>	
1. Remote 7	Remote (all instruments)
2. IFC	Interface Clear (all instruments)
3. Go to Local 7	(All instruments)
C. <u>Data Format</u> .	Data used to command the 363/488 to change bands is a single ASCII character, which represents the selected band as follows:

ASCII Character	Meaning	Active Amplifier
@	= Go to Standby	(amplifiers disabled)
A	= 2.00 to 3.4 MHz Band	(363/30 and 363/150 active)
B	= 3.4 to 5.9 MHz Band	(363/30 and 363/150 active)
C	= 5.9 to 10.2 MHz Band	(363/30 and 363/150 active)
D	= 10.2 to 17.5 MHz Band	(363/30 and 363/150 active)
E	= 17.5 to 30 MHz Band	(363/30 and 363/150 active)
F	= 30 to 51.3 MHz Band	(363/150 active)
G	= 51.3 to 87.7 MHz Band	(363/150 active)
H	= 87.7 to 150 MHz Band	(363/150 active)
I	= 150 to 225 MHz Band	(363/500 active)
J	= 225 to 337 MHz Band	(363/500 active)
K	= 337 to 500 MHz Band	(363/500 active)
L	= 500 to 725 MHz Band	(363/1000 active)
M	= 725 to 1000 MHz Band	(363/1000 active)
N	= Go to Standby	(amplifiers disabled)
O	= Go to Standby	(amplifiers disabled)

(Any ASCII character other than those listed, sent to the 363/488, will cause no change in the band selection).

D. Example Instruction - "Using H Model 85 calculator"

Output 7D2H "A"

Band Selection data (A is 2 to 3.4 MHz).

Decimal address set binarily with 5-bit code (A5S1).

Instruction to send data via IEEE-488 bus to system.

Table 4-4. Simplified Example of Typical 363/488 Program Using HP Model 85 Calculator

Index	Instruction
100	DISP @ DISP @ DISP @ DISP
110	DISP "Enter Desired Frequency"
120	INPUT F
130	If F > 0 then 180
140	Output 702; @
150	DISP @ DISP @ DISP
160	DISP "System in Standby"
170	Go to 100
180	If F > 2 then 220
190	DISP @ DISP @ DISP
200	DISP "Input Below Frequency Range"
210	Go to 100
220	If F > 3.4 then 240
230	X \$ = "A" @ Go to 150
240	If F > 5.9 then 260
250	X \$ = "B" @ Go to 510
260	If F > 10.2 then 280
270	X \$ = "C" @ Go to 510
280	If F > 17.4 then 300
290	X \$ = "D" Go to 510
300	If F > 30 then 320
310	X \$ = "E" @ Go to 510
320	If F > 51.3 then 340
330	X \$ = "F" @ Go to 510
340	If F > 87.7 then 360
350	X \$ = "G" @ Go to 510
360	If F > 150 then 380
370	X \$ = "H" @ Go to 510
380	If F > 225 then 400
390	x \$ = "I" @ Go to 510
400	If F > 337 then 420
410	X \$ = "J" @ Go to 510
420	If F > 500 then 440
430	X \$ = "K" @ Go to 510
440	If F > 725 then 460
450	X \$ = "L" @ Go to 510
460	If F > 1000 then 480
470	X \$ = "M" @ Go to 510
480	DISP @ DISP @ DISP
490	DISP "Input Above Frequency Range"
500	Go to 100
510	Output 702; X \$ (Note: In this example, the 363/488 address is set at 02)
520	Output 724: "FR", F "MZ" (Note: In this example, stable frequency source address is set to 24)
530	Go to 100

SECTION 5.0

ADJUSTMENTS/CALIBRATIONS

5.0 ADJUSTMENTS/CALIBRATION

5.1 Introduction

The only adjustment for the 363/800 system, other than the input attenuation adjustment performed by the operator, is the periodic calibration of the power meter on each amplifier.

5.2 Safety Precautions

Warning

The Model 363/800 Wattmeter Calibration System operates at radio frequencies up to 1000 Mhz and at power levels up to 800 watts, which can cause lethal or severe radiation burns to personnel if recommended safety precautions are not strictly observed. The human eye is at a particularly high risk of developing cataracts when subjected to repeated exposure to high-power levels of RF radiation. Do not operate exposed circuitry or radiating elements at high power levels when personnel must work in close proximity to the radiating source (particularly when close to the human head); always replace circuit shields during any high-power operations.

Maintenance personnel must observe all safety precautions at all times. Do not replace components inside the equipment with the input power turned on. Under no circumstances should any person reach into an enclosure for the purpose of servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid. Remove power from the system for all procedures that do not require power. For those procedures that do require power, be extremely cautious in handling test leads, tools, and equipment in the proximity of live RF circuitry. Always follow AMT's recommended procedures during any powered operation.

Hazardous line voltages exist within the subject equipment; avoid contact with these voltages to avoid injury.

CAUTION

Do not disconnect the RF output cable from a powered 363/800 unless the system is in the STANDBY mode and not capable of being remotely operated. Failure to observe this caution can generate transients and high VSWR that can damage the system or the test load.

Always ensure that an output RF cable and a suitable load are connected to the system before disconnecting or connecting a signal source to the input. Failure to observe this caution in a powered unit can generate damaging noise transients, which are greatly amplified through the linear amplifiers.

Ensure that output power levels do not exceed the specified maximum power limit of the load device under test to prevent damage from such excesses. Ensure that the nominal impedance of the load device is 50 ohms and is only driven within the specified frequency range to avoid damage to the load.

5.3 Calibration of Amplifier Power Meter

1. Verify system is in **Standby** mode.
2. Disconnect coaxial cable from J2 output connector of amplifier to be calibrated.
3. Connect serially an output attenuator and a power meter to output connector J2, as shown in Figure 5-1.
4. Provide excitation at input and adjust input level attenuators on 363/488 panel.
5. Adjust **High (Meter Cal)** control on amplifier panel to the indicated rated power (see Table 2-1) on the high scale of the amplifier wattmeter.
6. Reduce drive to approximately full scale for low power and adjust **Low (Meter Cal)** control for low scale rated power (see Table 2-1).
7. Remove test setup and replace coaxial cable.
8. Repeat steps 2 through 7 for each amplifier.

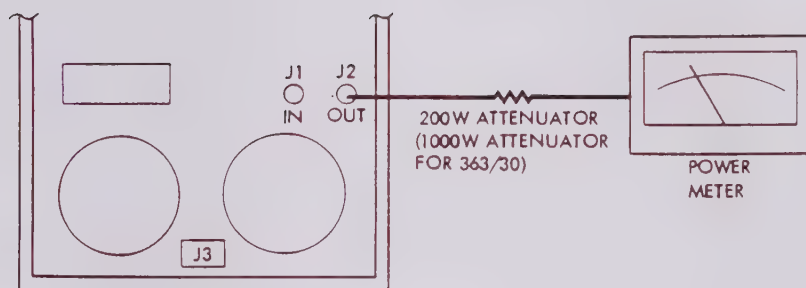


Figure 5-1. Setup for Amplifier Power Meter Adjustment

SECTION 6.0

MAINTENANCE

6.0 MAINTENANCE

6.1 Introduction

This section contains procedures and practices necessary to maintain the equipment. These procedures include preventive maintenance such as cleaning and lubrication, inspection criteria, and information necessary to remove, disassemble, inspect, reassemble, and install major components and assemblies of the system.

6.2 Preventive Maintenance

Cleaning and lubrication are recommended at periodic intervals to help maintain the equipment in serviceable condition.

- a. Cleaning. Clean the equipment in accordance with the following procedures:
 1. Clean exterior surfaces of the equipment excluding meter faces using a soft, clean cloth, moistened with isopropyl alcohol.
 2. Clean interior surfaces of the equipment with a soft, clean cloth, moistened with isopropyl alcohol. Loosen stubborn accumulations of dirt or other foreign matter with a non-metallic, stiff bristle brush.
 3. Clean filter screen on front panel of amplifier drawers by removing from the drawers and washing in a mixture of hot water and detergent. Allow filter screen to air dry before reinstalling on amplifier drawer.
- b. Lubrication. Lubricate the drawer slides in accordance with the following procedures:
 1. Pull the drawer fully open.
 2. Apply a light coat of lubricating oil along the entire length of the drawer slides. Wipe off excess oil with a soft, clean cloth. Close the drawer.
 3. Open and close the drawer several times to distribute oil evenly.

6.3 Removal/Installation

The following paragraphs provide procedures necessary to remove the drawers from the cabinet, to disassemble the amplifier and system controller to the module level, to inspect the equipment, and to reassemble and install the equipment.

Note: See Troubleshooting (Section 7.0) to establish the condition of a module or most probable cause of its malfunction. This is to determine the extent of disassembly required without the complete tear down and rebuild of an amplifier or the controller assembly.

WARNING

Make sure that electrical power to the system is disconnected before proceeding with any maintenance action. Failure to comply may cause injury or death to personnel.

Note: Perform maintenance functions in a clean, dust-free area.

- a. **Drawer Removal.** If drawer removal is necessary, perform the following procedures (see Figure 6-1):
 1. Disconnect the coaxial cables, ribbon cables, and power cord from the rear of the drawer.
 2. Remove the securing screws and pull the drawer completely forward.

WARNING

Total weight of a drawer is approximately 100 pounds. Make sure that sufficient personnel are present to support the drawer upon removal from the cabinet. One person should not try to remove the drawer by himself. Failure to comply may result in injury to personnel.

Only one drawer should be fully extended from cabinet at any time to prevent injury to personnel or equipment damage if cabinet topples.

3. Depress the two spring buttons located on either side of the drawer along the drawer slides.
4. Pull the drawer completely forward and off of the slides.

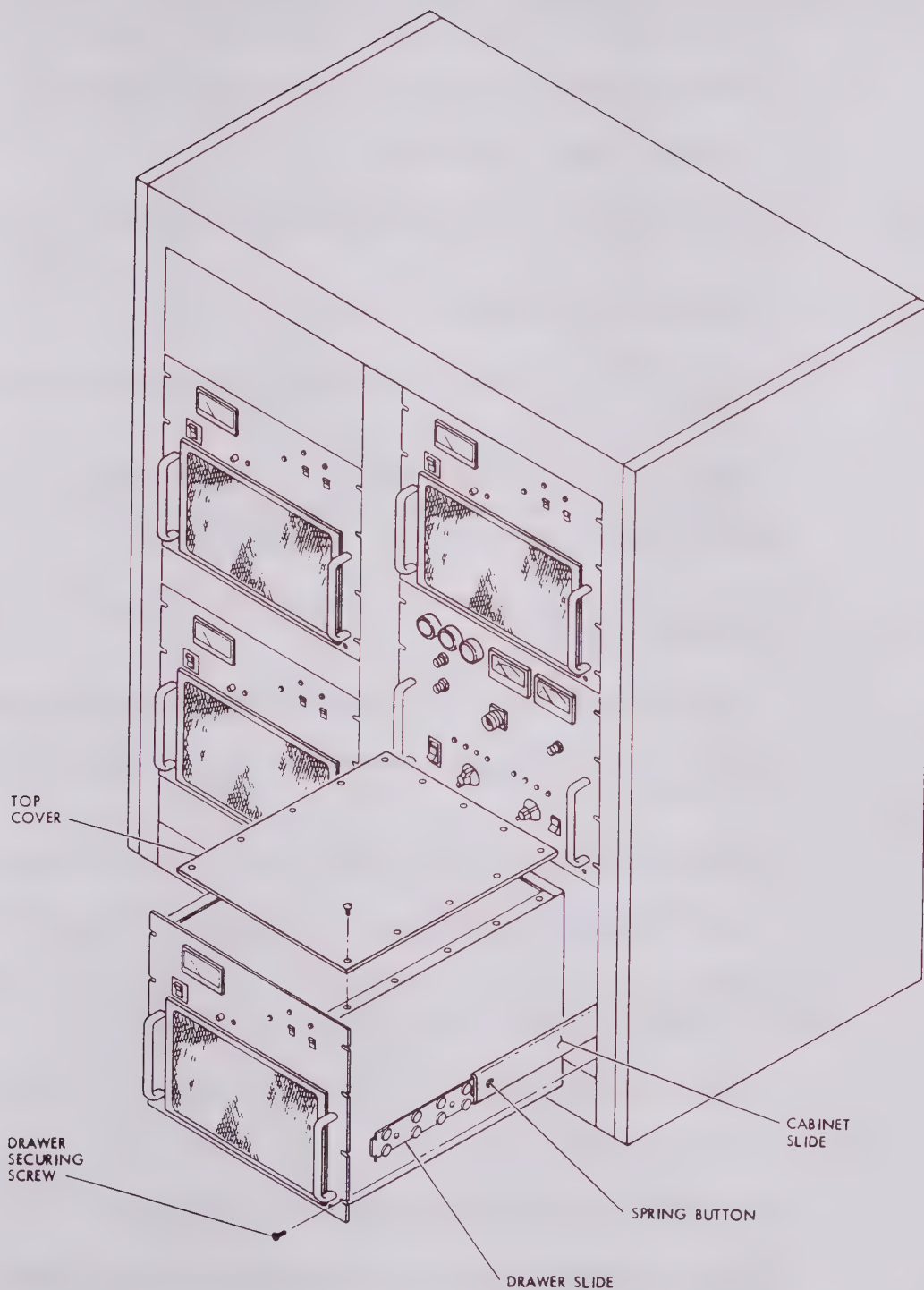


Figure 6-1. Drawer Removal From Rack

- b. Removal of Output Modules. Perform the following procedures to remove output modules from amplifiers 363/500 and 363/1000 (refer to Figure 6-2):
1. Remove the drawer from the cabinet (refer to paragraph 6-3.a).
 2. Turn the amplifier upside down.
 3. Remove all screws attaching the bottom cover to the side covers, rear cover and front panel.
 4. Remove the bottom cover.
 5. Disconnect and tag the coaxial cables from both ends of the output modules.
 6. Disconnect and tag the wires leading from the output modules and terminating either at the current monitor circuit board assembly or the terminal strip located adjacent to the current monitor.
 7. Remove the three screws from each side cover that attach the lower mounting shelf.
 8. Remove the lower mounting shelf with the two output modules attached.
 9. Remove the three screws from each side cover that attach the upper mounting shelf.
 10. Remove the upper mounting shelf with the two output modules attached.
 11. Remove the four attaching screws and remove the modules from the shelf.
- c. Removal of Output Modules. Perform the following procedures to remove output modules from amplifiers 363/30 and 363/150 (refer to Figure 6-3):
1. Remove the drawer from the cabinet (refer to paragraph 6-3.a).
 2. Turn the amplifier upside down.
 3. Remove the 12 flat head screws from the bottom cover.
 4. Remove all screws attaching the bottom cover to the side covers, rear cover, and front panel.
 5. Remove the bottom cover.

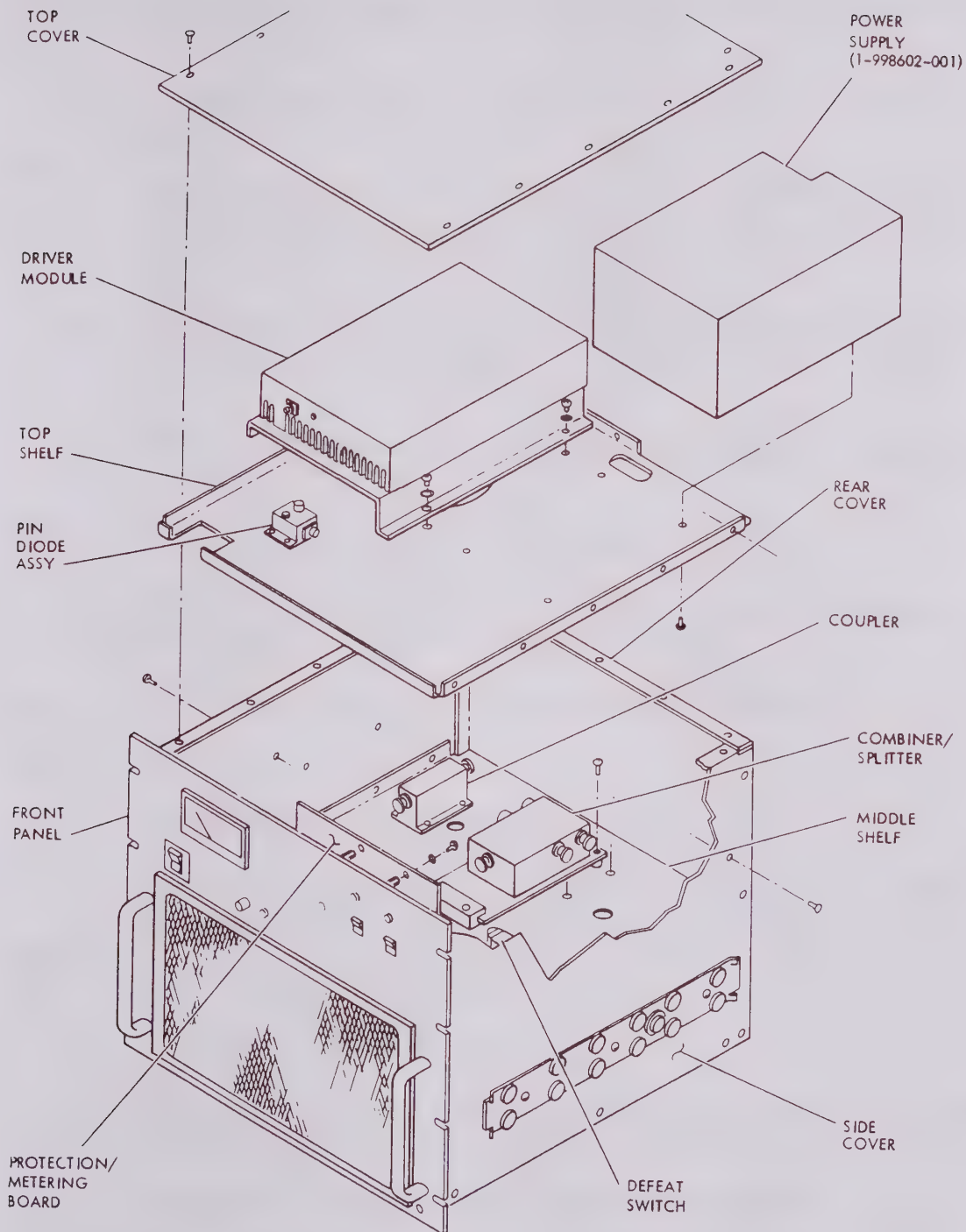


Figure 6-2. Top Access of Amplifier for Module Replacement

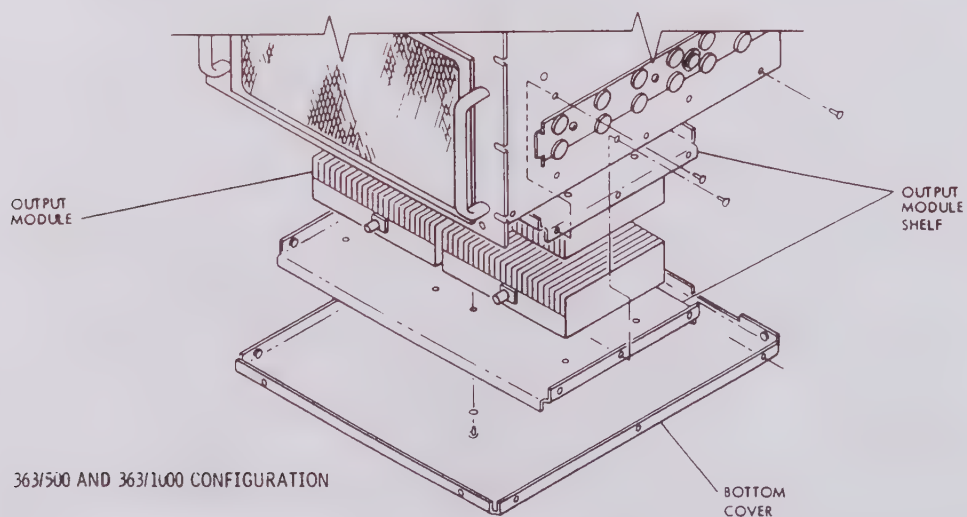
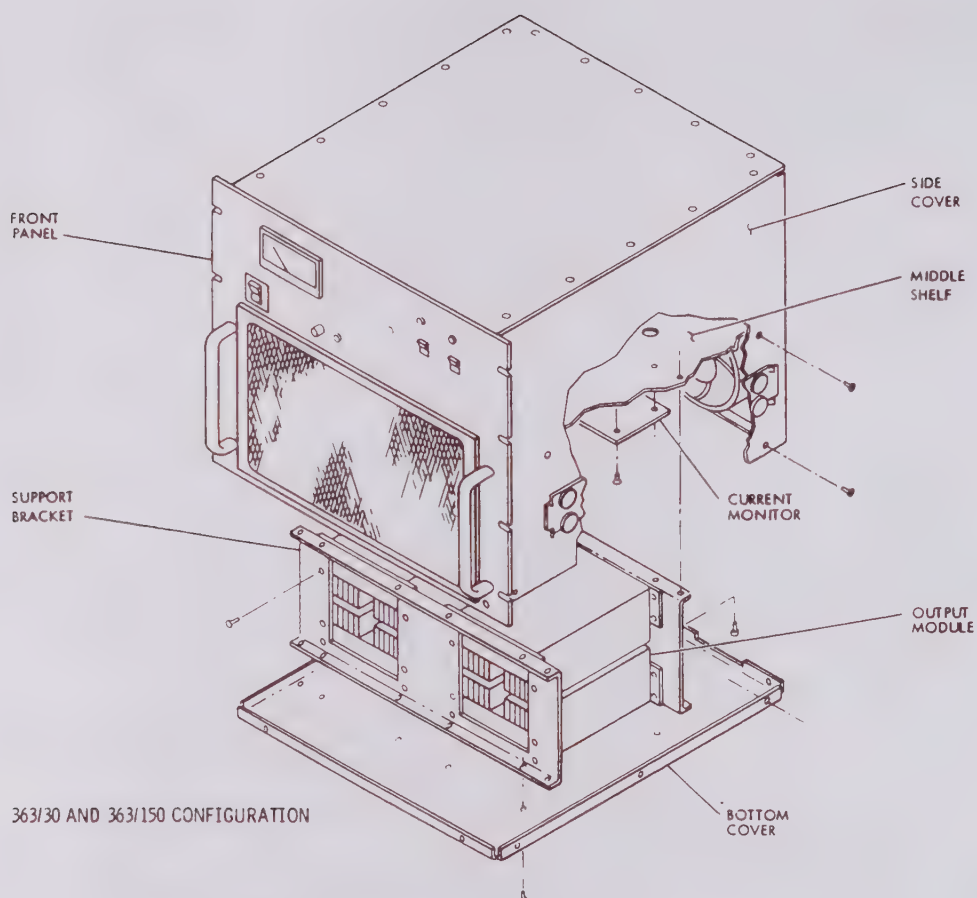


Figure 6-3. Bottom Access of Amplifier for Module Replacement

6. Remove the 12 screws attaching the output module support brackets to the middle shelf.
 7. Disconnect and tag the coaxial cables from both ends of the output modules.
 8. Disconnect and tag the wires leading from the output modules and terminating either at the current monitor circuit board assembly or the terminal strip located adjacent to the current monitor.
 9. Remove the entire module block assembly from the amplifier maintenance, and place it on a flat surface with the mounting screw holes toward the surface.
 10. Support the two upper modules and remove the 32 end plate attachment screws.
 11. Separate the end plates from the modules.
- d. Removal of Combiner/Splitters. Perform the following procedures to remove combiner/splitters from the amplifier (refer to Figure 6-2):
1. Remove the drawer from the cabinet (refer to paragraph 6-3.a).
 2. Remove the front panel.
 3. Remove the rear panel.
 4. Remove the two screws securing the combiner/splitters to the middle shelf and pull the assemblies out of the mounting block slot(s).
 5. Disconnect and tag the coaxial cables.
 6. Remove the combiner/splitters.
- e. Removal of Power Supply (PN 1-998602-001). Perform the following procedures to remove power supply from the amplifier (refer to Figure 6-2):
1. Remove the drawer from the cabinet (refer to paragraph 6-3.a).
 2. Remove the top cover.
 3. Remove the rear panel.

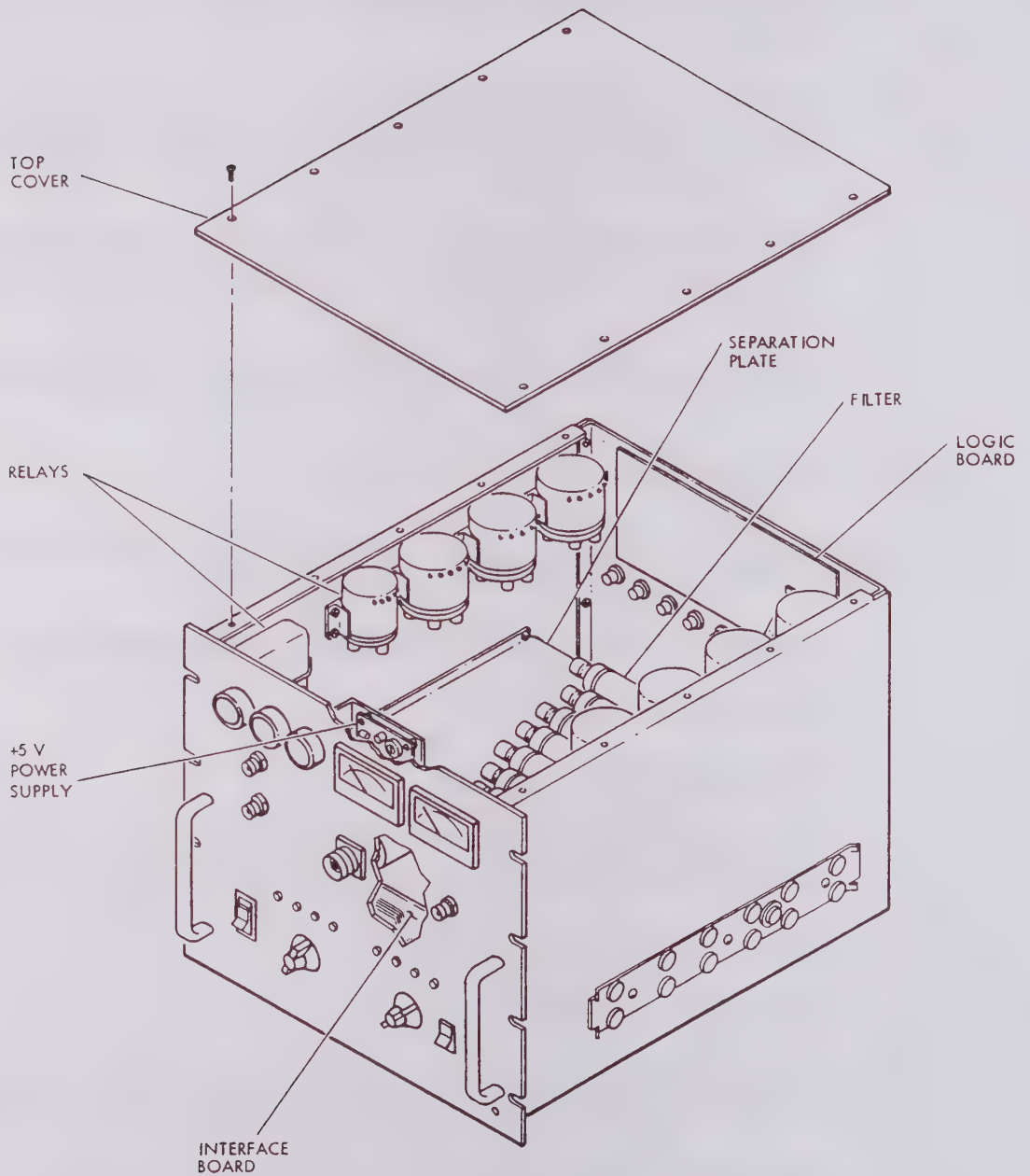


Figure 6-4. System Controller Details

7. Remove the relays from the sides of the system controller by removing the attaching hardware.
 8. Remove the internally mounted components or face panel mounted components as desired by removing the attaching hardware.
- k. Inspection of Components. Inspect components in accordance with the following procedures:
1. Inspect circuit boards for evidence of arcing or shorting. Check for damaged or peeling circuit traces.
 2. Inspect all wiring for evidence of shorts, breaks, or burned insulation.
 3. Inspect drivers, amplifiers, and power supplies for evidence of overheating or other physical damage.
- l. Reassembly. Reassemble components in accordance with the following procedures:
- In general, reassembly is accomplished in reverse order of disassembly with the following noted:
1. Use a low wattage soldering iron when reinstalling circuit boards or reconnecting wiring.
 2. Ensure that all components are clean and in serviceable condition before reassembly (refer to Preventive Maintenance Section for cleaning procedures).
- m. Drawer Installation. Install drawers in cabinet in accordance with the following procedures (refer to Figure 6-1):
1. Extend cabinet slides fully.

WARNING

Total Weight of a drawer is approximately 100 pounds. Make sure that sufficient personnel are present to support the drawer during installation in the cabinet. One person should not try to install the drawer by himself. Failure to comply may result in injury to personnel.

Only one drawer should be fully extended from the cabinet at any time to prevent injury to personnel or equipment damage if the cabinet topples.

2. Align drawer with slides in cabinet.
3. Push drawer backwards into rack until spring buttons on sides of unit engage into holes in cabinet slides.
4. Depress spring buttons and push drawer fully back into cabinet.
5. Reinstall securing screws at front of drawer.
6. Reconnect all cables at rear of drawers.

SECTION 7.0

TROUBLESHOOTING

7.0 TROUBLESHOOTING

7.1 Introduction

This section contains information to assist the maintenance technician in isolating equipment malfunctions in the AMT Model 363/800 Wattmeter Calibration System. Procedures contained in this section are designed to isolate faults to the lowest replaceable subassembly level and stress the replacement of faulty subassemblies with identical subassemblies (known to be functional) as the fastest and most reliable method of quickly restoring the system to a state of operational readiness. Such substitutions are also a ready means of confirming a fault diagnosis. (Troubleshooting defective subassemblies to the component level may be performed by referring to detailed schematics and using conventional circuit-measurement and signal-tracing techniques, which are not within the principal scope of this section).

Diagnostic troubleshooting information in this section is presented in the form of tables and diagrams keyed to common symptoms and the most likely causes. A prerequisite to efficient diagnostics is a well-understood knowledge of the theory of operation of the equipment being serviced. Accordingly, maintenance technicians are advised to become familiar with the functional descriptions contained in Section 3.0 (Theory) of this manual before attempting to service the subject equipment.

7.2 Safety Precautions

WARNING

The Model 363/800 Wattmeter Calibration System operates at radio frequencies up to 1000 MHz and at power levels up to 800 watts, which can cause lethal or severe radiation burns to personnel if recommended safety precautions are not strictly observed. The human eye is at a particularly high risk of developing cataracts when subjected to repeated exposure to high-power levels of RF radiation. Do not operate exposed circuitry or radiating elements at high power levels when personnel must work in close proximity to the radiating source (particularly when close to the human head); always replace circuit shields during any high power operations.

Maintenance personnel must observe all safety precautions at all times. Do not replace components inside the equipment with the input power turned on. Under no circumstance should any person reach into an enclosure for the purpose of servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid. Remove power from the system for all procedures that do not require power. For those procedures that do not require power, be extremely cautious in handling test leads, tools, and equipment in the proximity of live RF circuitry. Always follow AMT's recommended procedures during any powered operation.

Hazardous line voltages exist within the subject equipment; avoid physical contact with these voltages to avoid injury.

CAUTION

Do not disconnect the RF output cable from a powered 363/800 unless the system is in the STANDBY mode and not capable of being remotely operated. Failure to observe this caution can generate transients and high VSWR that can damage the system or the test load.

Ensure that a minimum 12-inch clearance exists at the back of the system cabinet and that all air-venting ports are clear of obstructions. Failure to observe this caution can restrict cooling air and cause overheating failures in areas not monitored by thermal sensors.

Always ensure that an output RF cable and a suitable load are connected to the system before disconnecting or connecting a signal source to the input. Failure to observe this caution in a powered unit can generate damaging noise transients, which are greatly amplified through the linear amplifiers,

Ensure that output power levels do not exceed the specified maximum power limit of the load device under test to prevent damage from such excesses. Ensure that the nominal impedance of the load device is 50 ohms and is only driven within the specified frequency range to avoid damage to the load.

7.3 Troubleshooting Index

Table 7-1 is a troubleshooting index which provides a tabulation of major fault symptoms with reference to probable causes, suggested isolation procedures, and recommended corrective actions. Where appropriate, references are given to the detailed troubleshooting procedures for the amplifiers and system controller appearing after Table 7-1. Pertinent data for troubleshooting the system is provided at the end of this section.

Table 7-1. Troubleshooting Index, Model 363/800 Calibration System (Sheet 1 of 8)

Index	TROUBLE SYMPTOM	PROBABLE CAUSE	ISOLATION METHOD	CORRECTIVE ACTION
1.	FRONT PANEL FAULT INDICATORS			
1.a.	OVER TEMPERATURE fault indicator is lighted	1. Dirty air filter 2. Restriction in air flow 3. Defective fan	Remove and visually examine air filter for dirt, clogging of screen, or other obstruction. Visually examine air inlet and exhaust vents for foreign obstruction or aperture blockage (e.g., other equipment covering air ports). Visually verify that fan rotates when unit is energized; deenergize unit and manually turn fan blades to verify free motion. Use voltmeter to verify that fan voltage is 120 ($\pm 10\%$) Vac.	Wash, dry soiled filter and reinstall. Remove any air flow obstruction and ensure all vents are clear to free flowing air. Replace faulty fan, repair faulty leads or connectors, as appropriate.

Table 7-1. Troubleshooting Index, Model 363/800 Calibration System (Sheet 2 of 8)

Index	TROUBLE SYMPTOM	PROBABLE CAUSE	ISOLATION METHOD	CORRECTIVE ACTION
1.b	CURRENT FAULT indicator is lighted.	1. An output has failed 2. System transient has set FAULT indicator	Set current fault defeat switch to DEFEAT position. Energize unit with specific source and output load; use clamp-on DC ammeter and measure supply current to each of four output modules. Module that draws significantly different current than companion modules is faulty (i.e., all four modules should draw approximately the same current). Deenergize system, reenergize and reinitialize operation to verify that FAULT indicator is not lighted.	Replace or repair faulty output module and then conduct performance verification tests. If symptom is chronic, check and repair faulty EMI filter components; if symptom is not chronic, no further action is required.

Table 7-1. Troubleshooting Index, Model 363/800 Calibration System (Sheet 3 of 8)

Index	TROUBLE SYMPTOM	PROBABLE CAUSE	ISOLATION METHOD	CORRECTIVE ACTION
1.c	OVER TEMPERATURE and CURRENT FAULT indicators both are lighted (concurrently)	1. Interface cable disconnected or defective	Check cable connector fittings to interface connectors. If okay, then remove cable and perform continuity check with ohmmeter.	Repair or replace faulty cable.
2.	ABNORMAL VOLT-METER/AMMETER READINGS (FRONT PANEL)			
2.a	No indications on both voltage and current	1. Unit operated at over temperature	Refer to symptom 1.a	Refer to symptom 1.a.
		2. Current fault	Refer to symptom 1.b.	Refer to symptom 1.b.
		3. Current monitor failure	Operate system on different frequency using an alternate power amplifier. If meters continue to produce no reading, then check cables and point-to-point troubleshooting of 488 pc board and front panel pc board. If using alternate power amplifier restores normal meter readings, then perform point-to-point troubleshooting of current monitor board of power amplifier that fails to produce meter readings.	Replace or repair faulty cable or pc board.

Table 7-1. Troubleshooting Index, Model 363/800 Calibration System (Sheet 6 of 8)

Index	TROUBLE SYMPTOM	PROBABLE CAUSE	ISOLATION METHOD	CORRECTIVE ACTION
3.a	OVERLOAD lighted (con'td)	2. Out-of-band operation	Verify that signal source frequency is correct for bandpass of selected power amplifier (conversely, verify that selected power amplifier is correct for selected frequency).	Reselect correct frequency versus power amplifier combination.
		3. Excessive output power	Measure RF output power and check against specified limit for selected power amplifier.	Reduce RF driving signal to level that does not cause excessive power output.
		4. Defective 363/488 system controller	Refer to troubleshooting procedures as outlined in following symptom 4.	Repair or replace defective 363/488 system controller subassemblies.
		5. Defective, disconnected or misconnected RF cable	Check each cable in series throughout defective channel for disconnected or misconnected RF cable. Ensure each cable is of correct impedance and power-handling specification (i.e., verify all cables are of specified RG-type/u). If not corrected, substitute known good cable for each cable in defective channel series until symptom is eliminated.	Restore cable connection or replace defective cable.

Table 7-1. Troubleshooting Index, Model 363/800 Calibration System (Sheet 7 of 8)

Index	TROUBLE SYMPTOM	PROBABLE CAUSE	ISOLATION METHOD	CORRECTIVE ACTION
4.	366/488 SYSTEM CONTROLLER PROBLEMS			
4.a	Low or no output power and high reflected power (OVERLOAD indicator may or may not light).	1. Loose or faulty coaxial connector	Check all RF connectors for loose or faulty connector, in accordance with paragraph 7-12.	Tighten loose connector or replace faulty connector.
		2. Inoperative or faulty coaxial relay	Check selected relays for operating voltages in accordance with Table 7-4.	If any relay voltage is missing check out interconnect cable and connectors, if logic cable okay, then troubleshoot controller board. If all voltages correctly appear on selected relays, then check relay contact continuity. Replace faulty relay.
		3. Faulty controller PC board	Use controller schematic and perform check of digital logic states in accordance with Table 7-4. Check 5-volt DC power supply. Check front panel switch inputs.	Replace faulty component or interconnect cable.

Table 7-1. Troubleshooting Index, Model 363/800 Calibration System (Sheet 8 of 8)

Index	TROUBLE SYMPTOM	PROBABLE CAUSE	ISOLATION METHOD	CORRECTIVE ACTION
4.a	Low output power	4. Mismatched or faulty RF output load 5. Frequency source operating at out-of-band frequency	Check load for impedance and wattage rating. Substitute known functional output load. Measure signal source frequency ; verify frequency is correct for selected band.	Replace incorrect or faulty RF output load. Retune signal source to correct frequency for the selected band.

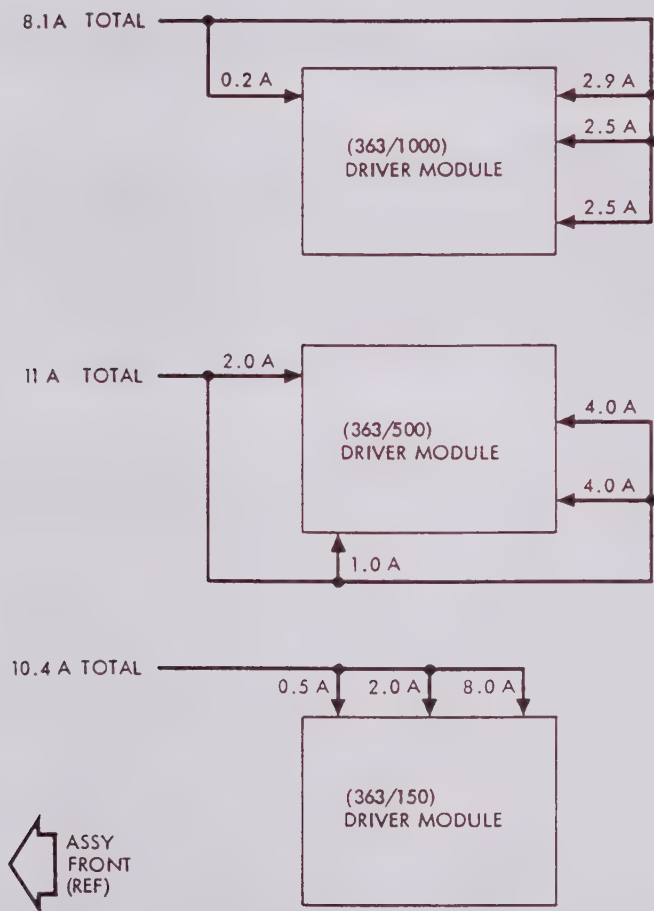


Figure 7-1. Test Point Locations and Rated Currents: Driver Modules

7.4 General Troubleshooting

The Model 363/800 Wattmeter Calibration System has front panel meters and LED indicators, which can be used by maintenance personnel to provide a broad indication of a malfunctioning major subassembly in most cases. Front-panel LED indicators placarded **Over Temperature**, **Current Fault**, and **Overload**, used in conjunction with the panel voltmeter, ammeter, and Forward/Reflected wattmeter, are the principal panel instruments that may be used as diagnostic aids.

Many RF malfunctions can be located by measuring the DC currents that supply the circuit being investigated; an RF problem in an amplifier usually causes a shift in DC operating parameters, which can be detected by taking appropriate current measurements.

It is sometimes helpful to operate a subunit amplifier independently from the 363/488 system controller; in order to effect such independent operation, pins 4 and 8 of the logic interface connector (J3) must be jumped together. When energizing an amplifier, always ensure that the RF output is connected to a suitable load of proper power rating, operating impedance and frequency range.

7.5 Amplifier Troubleshooting

If a current fault is indicated in an amplifier (shown by the front panel **Current Fault LED** lighting when the amplifier is selected), remove the indicated drawer assembly from the cabinet (refer to paragraph 6-3.a).

Remove the top cover and set the current fault defeat switch (located on the right hand side cover) to the **Shutdown Defeat** position.

Invert the amplifier and remove the bottom cover (thus exposing the output modules and current monitor pc board). Reenergize the amplifier.

NOTE

If the amplifier to be checked is a Model 363/30 assembly, a suitable RF signal must be used to drive its input with the output connected to a suitable load, since the normal idling current in this model is too low to show as a current fault under a failed condition.

There are three LED indicators on the current monitor pc board: CR10 (right), CR9 (left), and CR8 (difference). Observe which of the three LED indicators is lighted when the amplifier is powered. Indications are as follows:

- | | | |
|-----------------------------------|----|---|
| • LED CR10 is lighted | -- | One of two modules on the right side (E7 or E8) has failed. |
| • LED CR9 is lighted | -- | One of two modules on the left side (E5 or E6) has failed. |
| • LED CR8 (difference) is lighted | -- | Two modules on the same side have failed. |

The next step requires use of a clamp-on type DC ammeter to isolate the defective module. (As previously noted, performing this test on a Model 363/30 module requires that its input be driven by an RF signal level of approximately 10 watts, which produces approximately 500 watts output in a normally functioning amplifier). Using the DC clamp-on ammeter, measure the current drawn by each of the suspected modules: The defective module will usually produce a DC current reading that is substantially less than the normal operating current of the companion modules under the same operating conditions.

7.6 Isolating Shorted Modules

If the front panel 363/488 voltmeter displays a low or zero voltage and the ammeter reading is also low, then a shorted or defective power supply is indicated.

If the problem is concurrent with a lighted front panel **Current Fault** indicator, then the shorted module is one of the output modules; if the **Current Fault** indicator is **not** lighted, the shorted amplifier is the driver module.

Find a shorted output module by setting the current fault defeat switch in the **Defeat** position, energizing the amplifier assembly and using the LED indicators on the current monitor pc board as an initial location guide. Measure the current drawn by each of the four modules. Table 7-2 lists the idle currents for each amplifier. The shorted output module will usually draw the majority of the current. (Note that for this short-circuited test, the Model 363/30 module need not be driven with an RF test signal).

To isolate a shorted or defective driver module, set the amplifier assembly upright and remove the top cover to expose the driver and power supply. Using the DC current probe, check each test point marked for specified current: these test points and their respective typical measurements are shown in Figure 7-1. If all readings are exceptionally low except for one that is exceptionally high, a short circuit should be suspected. An abnormal current reading, deviating from normal by 20% or more is reason to replace the driver module. If all currents and voltages appear to be normal, but little or no RF output power is produced, then an RF performance verification test of the modules should be conducted to locate the problem. Refer to paragraph 7-9 for the performance verification test procedure.

Table 7-2. Amplifier Idle Currents

Unit	Item		Amps
363/30	Output module .02 amps $\pm 25\%$ X 4	=	0.8
363/150	Driver 10.4 amps	=	10.4
	Output modules 8 amps X 4	=	<u>32.0</u>
			42.4
363/500	Driver 11 amps	=	11.0
	Output modules 8 amps X 4	=	<u>32.0</u>
			43.0
363/1000	Driver 8.1 amps	=	8.1
	Output modules 5 amps X 4	=	<u>20.0</u>
			28.1

7.7 Testing Protection/Metering Board

To check a protection circuit board, operate the amplifier with no signal and measure the following test points:

<u>Test Point</u>	<u>Reading</u>
TP 403	0 V $\pm$ 10 millivolts
TP 404	0 V $\pm$ 10 millivolts
TP 405	0 V $\pm$ 10 millivolts
TP 406	0 V $\pm$ 10 millivolts
TP 407	0 V $\pm$ 10 millivolts
TP 408	0 V $\pm$ 10 millivolts
TP 409	0 V $\pm$ 10 millivolts
TP 410	$\approx$ -1.5 V $\pm$ 25%
TP 411	-0.6 V $\pm$ 25%
TP 412	$\approx$ -1.0 V $\pm$ 25%

The power supply voltages (± 12 VDC $\pm 5\%$) can be checked by connecting a DVM between the positive lead of C406 and ground for ± 12 VDC or between the negative lead of C406 and ground for +12 VDC or between the negative lead of C407 and ground for -12 VDC. If any of the above test point voltages are not within the specified limits, the board should be considered defective and replaced.

7.8 Calibration for Protection/Metering Board

After replacement of the protection/metering board, perform the following calibration procedure:

1. Adjust R449, R450, and R451 fully counterclockwise (CCW).
2. Adjust R444, R446, and R447 fully clockwise (CW)

3. Drive the amplifier with no load to 15% (25% for 363/30) of its rated power; adjust R444 until the overload light comes on and the power is limited to 10% (20% for 363/30) of rated power.
4. Connect a load and external power meter.
5. Drive the amplifier to 100% of rated power.
6. Connect a DVM to TP 407.
7. Adjust R451 approximately two turns from its CCW stop.
8. Verify DVM reads 0 ± 10 millivolts.
9. Adjust R446 CCW until the DVM reads +30 millivolts.

NOTE

If R446 reaches the CCW stop before the DVM reads a positive voltage, adjust R447 CCW also until the DVM reads +30 millivolts.

10. Adjust R451 until the amplifier limits 125% of rated power.

NOTE

A slight readjustment of R451 and R446 may be necessary especially in the 363/30 unit when the amplifier is connected to the system controller (363/488) for optimum results.

7.9 Driver Module Performance Test

A driver module can be RF tested by disconnecting its output (normally connected to a splitter module) and reconnecting it to an attenuator and power meter. Excite the drive module input with an RF signal level between -10 dBm and 0 dBm; the driver module output power should be approximately 30% of the amplifier total rated output as follows:

<u>Driver Module Assy</u>	<u>Amplifier Assy Total Rated Output</u>	<u>Driver Test Level Minimum Output (30%)*</u>
363/150	200 Watts	60 Watts
363/500	200 Watts	60 Watts
363/1000	100 Watts	30 Watts

* The saturated power output level of a driver is typically 1.5X of level listed.

7.10 Output Module Performance Test

Individual output modules (one of four) can be RF tested alone by connecting a 6 dB attenuator (having a minimum rating of 50 watts) between the driver module output and the input of the single output module to be tested (in lieu of the power splitter, which is disconnected during the test). Serially connect an output attenuator (minimum 50-watt rating) and a power meter to the RF output of the individual output module being tested, as shown in Figure 7-2. By exciting the input, the resultant RF power level should be approximately 1/4 of the rated power output of amplifier assemblies (based upon all four outputs), but the required input drive level should be less than for the total assembly, since the collective power gain of all four output modules operating together is greater than 6 dB. Ensure that the RF test set-up described is not over driven.

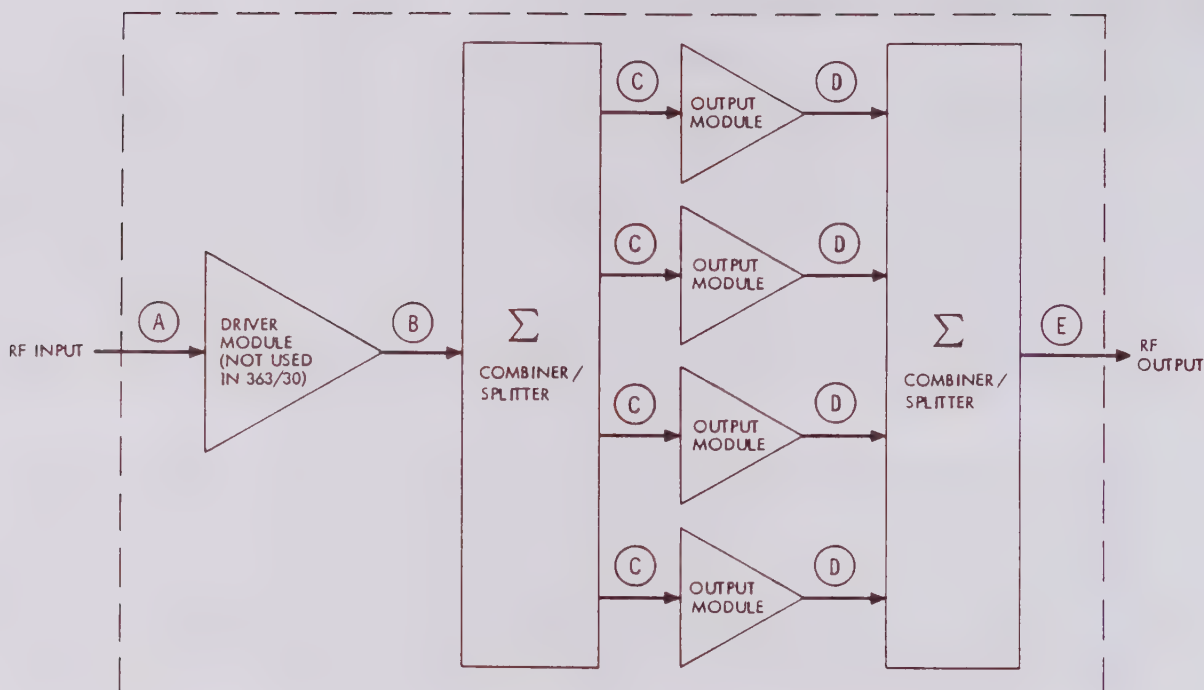
Note that the output modules in the Model 363/30 may be tested individually using the driver module in the Model 363/150 as the drive source. The Model 363/30 current fault defeat switch must be set to the **defeat** position because, otherwise, driving just one 363/30 output module will cause the current fault circuitry to shut down the power supply. Do not use an RF input level to the Model 363/150 driver module (during this test) that exceeds the RF drive level normally required to produce the rated amplifier assembly output under normal conditions.

7.11 Module Test Summary

Although testing the modules of the amplifier assemblies in the manner described in the preceding paragraphs will not produce exact results, this test method can usually be used to locate a defective module. When additional test equipment is available (such as low-power amplifiers, power meters, and power supplies), testing with greater accuracy can be performed using the test setup shown in Figure 7-3. Module performance data, found in Table 7-3 and Figures 7-1 and 7-4, provides the necessary performance criteria for the described module testing. Maintenance personnel are reminded that the quantitative data shown in these reference aids are examples of typical measurements and actual measurements will vary from amplifier to amplifier. The most important performance criteria for the output modules that operate together as a set is that all four operate the same. The most important performance criteria for all driver modules is that their minimum RF power output levels be at least 30 % of the respective amplifier rated output level; typically, driver modules will produce up to 1.5 times the 30% level when driven to saturation.

Disassembly procedures for removing the power supply, driver module, combiner/splitters, and output module are found in Section 6.0 (Maintenance).

The Troubleshooting Index, Table 7-1, is provided as a concise reference to aid in fault isolation procedures. The isolation methods recommended in the Troubleshooting Index may be used in conjunction with the test methods described previously.



Common Reference: Amplifier Assy Block Diagram

Amplifier Assy Model No.	A	RF POWER LEVEL EXPRESSED IN WATTS*			
		B	C	D	E
363/30	uses 363/150 driver output	20	5	220	800
363/150	-10 dBm	36	8	56	200
363/500	-10 dBm	56	12.5	56	200
363/1000	-5 dBm	28	6.25	28	100

* RF power levels listed are typical; actual measurements in equipment may vary.

Figure 7-4. Typical RF Characteristics of Model 363/800 System Components

Table 7-3. Pin Functions for Amplifier Interface Connector (Typical for J9-J12)

PIN NO.	P/N FUNCTION
1	Temperature Fault
2	Current Fault
3	363/150, 363/500, and 363/1000 Supply Voltage
4	Power Supply Inhibit
5	Connected in 363/150 only; to Switch Drive Output to 363/30 Assy
6	Supply Voltage for the 363/30 only
7	Amplifier Current Sense
8	Logic Ground, Amplifier
9	Supply Return
10	Pin Diode Protection (Models 363/30 and 363/150 only)
11	not connected
12	not connected
13	not connected
14	Amplifier Current Sense

7.12 Troubleshooting The 363/488 System Controller

A malfunction in the Model 363/488 system is diagnosed from symptoms of lack of output power and of high reflected power (indicated by the selected amplifier's operation) occurring and usually accompanied with a lighted overload indicator. When these symptoms exist, try to determine whether the symptoms occur only when one particular amplifier assembly is selected or if the symptom occurrences are common to all selections of any amplifier assembly.

To gain access to the 363/488 system controller unit, the entire unit may be withdrawn from the cabinet, on the attaching extender slides, by removing the front panel fasteners and sliding the unit forward. Coaxial RF cables may be disconnected from the unit to effect various test set ups; but the logic ribbon cable must remain connected during power-on tests, since this cable conducts the power for the system relays, which power is furnished by the power supply in the operating amplifier unit. Should independent operation of the Model 363/488 (apart from the system) become necessary, a 24-volt DC power supply must be connected to any one of the three logic connectors (J10, J11, or J12), as follows: Connect the positive supply lead to pin 3 and the negative supply lead to pin 9 (steering diodes pass the supply current from these pins on any of the three connectors to the relay supply bus).

The first check to be performed in troubleshooting the 363/488 controller is to verify that the correct DC voltage level exists on the switching relays. A truth table, Table 7-4, provides a troubleshooting reference for verifying the voltage status on each coaxial relay (K1-9) for each of the selected band conditions. If one or more voltages are in error, the fault is in the wiring harness, the logic board, or the front panel board. Table 7-5 provides a truth table for troubleshooting reference in verifying the voltage status of connector pins or the logic board.

The front panel printed circuit board circuitry inverts the logic levels for relays designated K2 through K8; relays designated K1 and K9 are connected directly from the Molex connector to the 24-pin relay connector via conductor traces on the front panel circuit board.

If the 363/488 controller operates properly when the system is in the manual mode, but fails to switch during the bus controlled mode, the interface circuit board is suspected. If the bus controlled mode switches properly, but the manual mode doesn't, then the front panel **Band Frequency** selector switch or the standby circuit should be investigated.

If the control voltages test out properly, then an RF or signal continuity check should be conducted. The fastest and easiest check to make is to perform a DC continuity check. This check may be performed by using a low-range ohmmeter and connecting one lead to the center conductor of the type GR900 RF output connector and verifying the following series paths with the alternate lead:

- Bands A through E - Continuity to rear connector of 363/30.
- Bands F through I - Continuity to the 363/150 connector.
- Bands J through K - Continuity to the 363/500 connector.
- Bands L through M - Continuity to the 363/1000 connector.

Next, move the first ohmmeter lead from the output connector to the RF input connector center pin and verify the following series paths with the alternate lead:

- Bands A through G - Continuity to the 363/150 input connector.
- Bands I through K - Continuity to the 363/500 input connector.
- Bands L through M - Continuity to the 363/1000 input connector.

An alternate test method of isolating faulty links in the RF transmission series (throughout the coaxial relay system) is to drive the powered system with a very low-level RF test signal. Since this test is a scaled down simulation of actual operating conditions, the results tend to be more accurate than passive continuity tests. When conducting such tests, ensure that the correct test frequency is used for the band being tested. Typically, about 1 dB of loss will occur through the output relay and filter circuit, and less than 2 dB of loss will occur through the input relay circuit. Once the defective signal path is identified, further investigation will narrow the fault location to a defective component (e.g., a filter, relay, or cable).

Table 7-4. Voltage Truth Table for Coaxial Relay Voltage States

RELAY REF DESIGNATOR	SEL PINS	@	SELECTED OPERATING BAND												
			A	B	C	D	E	F	G	H	I	J	K	L	M
K1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	2	0	0	0	0	0	0	0	0	0	1	1	1	0	0
	3	0	1	1	1	1	1	1	1	1	0	0	0	0	0
K2/K3	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0
K4/K5	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0
K6/K7	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0
K8	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0
K9	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	3	0	0	0	0	0	0	1	1	1	0	0	0	0	0
	4	0	1	1	1	1	1	0	0	0	0	0	0	0	0
	5	0	0	0	0	0	0	0	0	0	1	1	1	0	0

0 = < 0.5 v dc

1 = > 1 v dc

Table 7-5. Logic Circuit Board Voltage Truth Table

Pin J6	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
@	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0				
A	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0				
B	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0				
C	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0				
D	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0				
E	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0				
F	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	0	0	1	0	0				
G	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	0	1	0	0				
H	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0	0	1	0	0				
I	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	0	0	0	1	0				
J	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	0	0	0	1	0				
K	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	0	0	1	0				
L	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	0	0	0	1				
M	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	1				
N	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0				
O	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0				

[(J9)				(J10)				(J11)				(J12) = Rear Panel Connector			
Pin J1	1	2	4	J2	1	2	4	J3	1	2	4	J4	1	2	4
@	0	0	1		0	0	1		0	0	1		0	0	1
A	1	1	0	*	0	0	1		0	0	1		0	0	1
B	1	1	0	*	0	0	1		0	0	1		0	0	1
C	1	1	0	*	0	0	1		0	0	1		0	0	1
D	1	1	0	*	0	0	1		0	0	1		0	0	1
E	1	1	0	*	0	0	1		0	0	1		0	0	1
F	0	0	1		1	1	0		0	0	1		0	0	1
G	0	0	1		1	1	0		0	0	1		0	0	1
H	0	0	1		1	1	0		0	0	1		0	0	1
I	0	0	1		0	0	1		1	1	0		0	0	1
J	0	0	1		0	0	1		1	1	0		0	0	1
K	0	0	1		0	0	1		1	1	0		0	0	1
L	0	0	1		0	0	1		0	0	1		1	1	0
M	0	0	1		0	0	1		0	0	1		1	1	0
N	0	0	1		0	0	1		0	0	1		0	0	1
O	0	0	1		0	0	1		0	0	1		0	0	1

1 => 1 VDC
0 =< 0.5 VDC

* If Pins 1 and 2 of J1 are forced low, then Pins 1 and 2 will go high and Pin 4 of J2 will go low.

SECTION 8.0

ILLUSTRATED PARTS LIST

8.0 ILLUSTRATED PARTS LIST

8.1 Introduction

This section contains an illustrated listing of all replaceable modules of the Model 363/800 Wattmeter Calibration System. The parts lists are keyed to illustrations that precede each list. A numerical index, by part number, is provided at the end of the illustrated listing.

8.2 Parts List Form

The form has five columns to present the information for each part. The type of information presented in each column is discussed to acquaint the user with the purpose of the column data. The following are used in the parts lists:

<u>Abbreviation</u>	<u>Meaning</u>
Assy	Assembly
DC	Direct Current
Fig.	Figure
FSCM	Federal Supply Code of Manufacturers
NHA	Next Higher Assembly
No.	Number
PWBA	Printed Wiring Board Assembly
REF	Reference
Res.	Resistor
RF	Radio Frequency

8.3 Figure and Index Number

The first digits followed by a hyphen in this column are the figure number, which is the number contained in the figure title typed on the illustration page preceding the parts list. The column numbers to the right of the figure number are the index (item) numbers. Each index number corresponds to the index number placed on the illustration.

8.4 AMT Part Number

This column lists the assigned number for each part. This part number should be used for ordering any replacement part.

8.5 Nomenclature

The description includes nomenclature of each part, identification details, explanatory information, and assembly relationships. Each assembly is indented properly to show its relationship to the assembly.

8.6 Manufacturing Part Number

Original manufacturing part number for parts which are not altered are listed for identification only. These part numbers should not be used for ordering replacement parts.

8.7 Vendor Codes (FSCM)

Vendor's parts used in the assemblies and which are not altered are listed by the vendor's description of the part, and the vendor's code. Vendor's coded symbols used in this publication are taken from Federal Supply Code of Manufacturers (FSCM) Cataloging Handbook H4-1.

8.8 Units Per Assembly

Quantities specified in the "Units per Assy" column are the total number of each listed part required per assembly or subassembly and are not necessarily the total used in the complete equipment. The notation "REF" in this column indicates an item listed for reference only.

A numerically arranged list is given below for the vendor codes used in this publication. This list also includes the vendor code for AMT. However, this code identification has not been included in the illustrated parts list. The absence of a code following a part description in the illustrated parts list means that the item is an AMT part.

<u>Code</u>	<u>Vendor's Name and Address</u>
03030	Empro mfg. Co. Indianapolis, IN
04713	Motorola, Inc. Phoenix, AZ
05245	Corcom, Inc. Libertyville, IL
07355	Airpax Electronics, Inc. Fort Lauderdale, FL
09353	C & K Components, Inc. Watertown, MA
11726	Lambda Qualidyne San Diego, CA
15542	Mini-Circuits Brooklyn, NY
23042	Trilithica, Inc. Indianapolis, IN
23936	Papst-Pamotor Corp. Burlingame, CA
50667	Dynatech, Inc. Calabasas, CA
51106	Standard Power, Inc. Santa Ana, CA
70998	Bird Electronic Corp. Solon, OH
71400	Bussmann St. Louis, MO
77342	Potter and Brumfield Princeton, IN
OEKW3	Eagle Wichita, KZ
1EV63	American Microwave Technology Brea, CA

Fig Item	AMT Part No.	Nomenclature	MFG Part No.	FSCM	Units Per Assy
8-1	4-006237-001	Wattmeter Calibration System, Model 363/800			REF
1	4-006238-001	Final Assy, Amplifier 363/30 (See Fig. 8-2 for details)			1
2	4-006189-001	Final Assy, Amplifier 363/150 (See Fig. 8-3 for details)			1
3	4-006239-001	Final Assy, Amplifier 363/500 (See Fig. 8-4 for details)			1
4	4-006240-001	Final Assy, Amplifier 363/1000 (See Fig. 8-5 for details)			1
5	4-006318-001	Final Assy, System Controller 363/488 (See Fig. 8-6 for details)			1

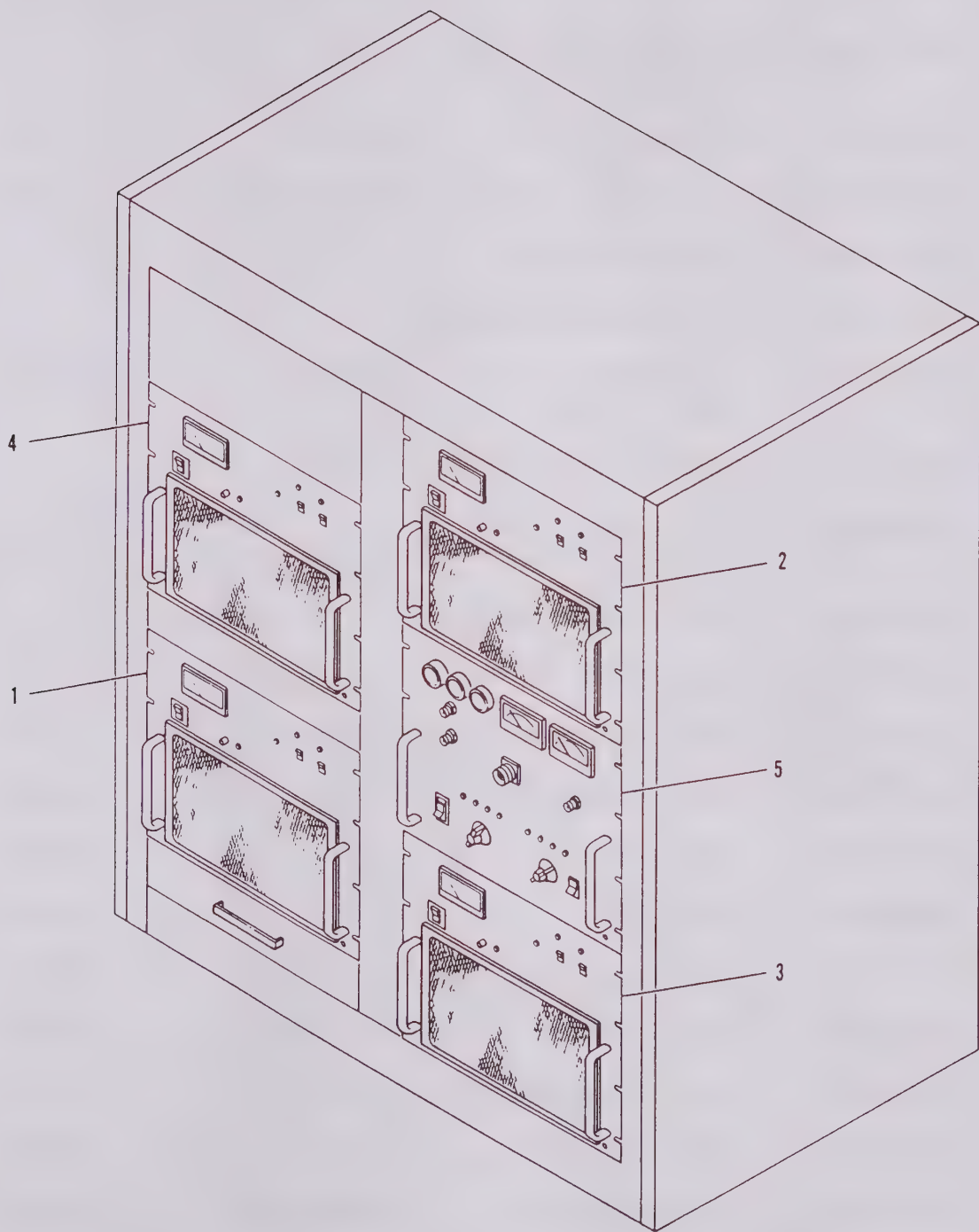


Figure 8-1. Model 363/800 Wattmeter Calibration System

Fig Item	AMT Part No.	Nomenclature	MFG Part No.	FSCM	Units Per Assy
8-2	4-006238-001	Final Assy, Amplifier 363/30 (See Fig. 8-1 for NHA)			REF
1	1-968016-001	• Power Supply (PS3)	SPS-60-12	51106	1
2	1-998602-001	• Power Supply (PS1, PS2)	10JG00D-0093	11726	2
3	4-006235-001	• Combiner, Output (A6)			1
4	4-006188-001	• Combiner/Splitter Assy (A5)			1
5	3-404536-003	• Coupler Assy, Directional (DC1)	4144-140	70998	1
6	3-006302-001	• PWBA, Current Monitor (A9)			1
7	4-006293-001	• Amplifier Assy, Output Module (A1, A2, A3, A4)			4
8	4-006173-001	• PWBA, Protection/Metering (A8)			1
9	4-404550-001	• Meter, Amplifier (M401)			1
10	1-924018-002	• Switch, Circuit Breaker (CB1)	203-222-1-62-203-4-1-1	70355	1
11	1-951069-004	• Switch, Rocker (S402, S403)	7101J51CQE-2-2	09353	2
12	1-951069-003	• Switch, Lever (S4)	7201-J61	23936	1
13	1-939003-001	• Fan (B1, B2)	7600S	23936	2
14	1-919024-001	• Filter, Power Line (FL1, FL2)	20B6	05245	2
15	1-942047-103	• Relay, Sensitive (K1)	R10E1Y4S450	77342	1
16	1-998728-001	• Shunt, D.C. Ammeter (R1)	A-75-100	03030	1
17	1-913231-001	• Diode, Power (CR1)	MR1120	04713	1
18	1-945001-169	• Res., 2K, 1/2 W (R2)	RC20GF202J5	COML	1
19	1-945001-210	• Res., 100K, 1/2 W (R3)	RC20GF104J5	COML	1

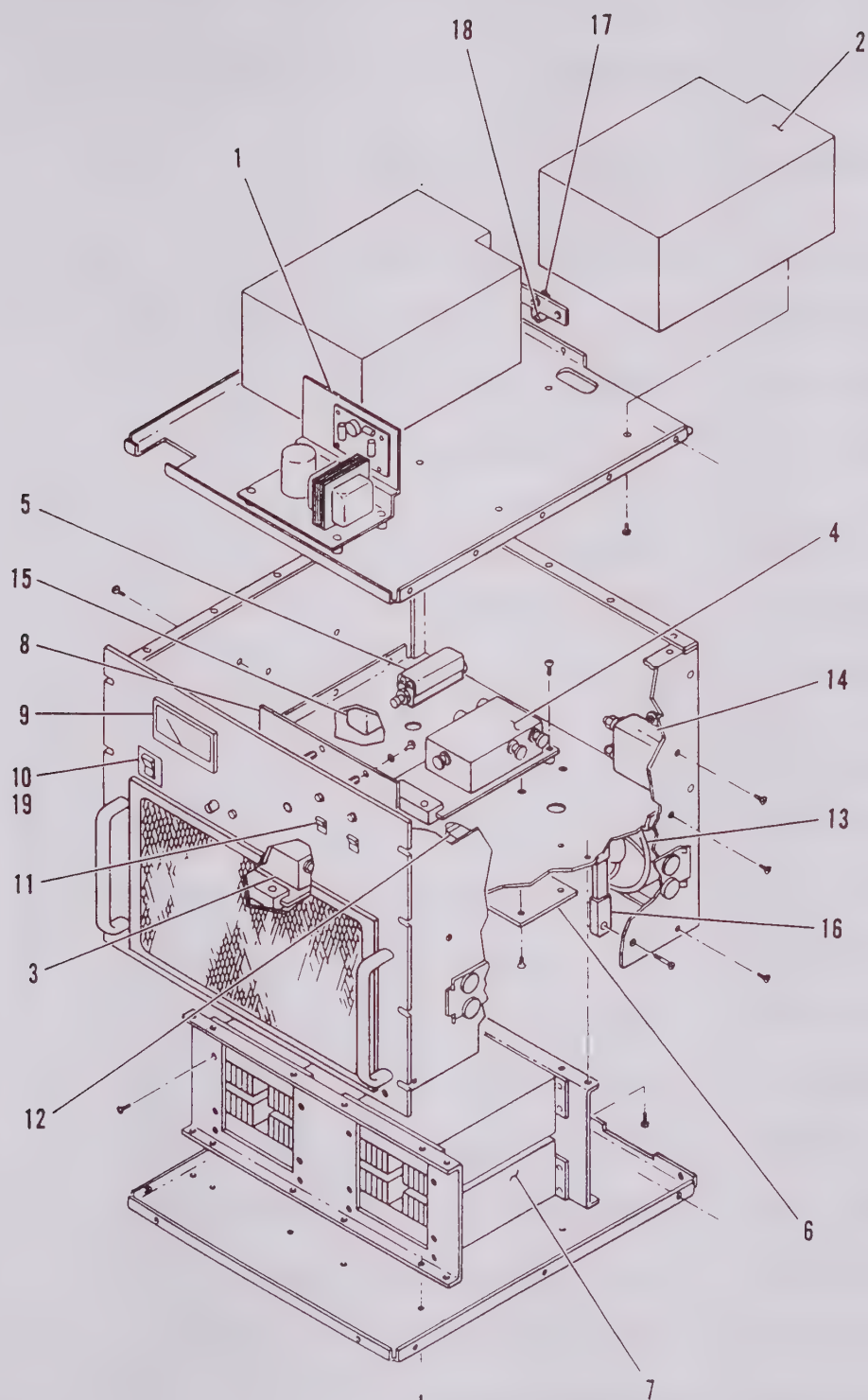


Figure 8-2. Amplifier 363/30 Exploded View

Fig Item	AMT Part No.	Nomenclature	MFG Part No.	FSCM	Units Per Assy
8-3	4-006189-001	Final Assy, Amplifier 363/150 (See Fig. 8-1 for NHA)			REF
1	4-006156-001	• Amplifier Assy, Driver (A5)			1
2	1-998602-001	• Power Supply (PS1)	10JG00D-093	11726	1
3	3-006157-001	• Diode Assy, Pin Switch (A6)			1
4	4-006188-001	• Combiner/Splitter Assy (A7, A8)			2
5	4-006175-001	• Coupler Assy, Directional (DC1)			1
6	3-006302-001	• PWBA, Current Monitor (A11)			1
7	4-006187-001	• Amplifier Assy, Output Module (A1, A2, A3, A4)			4
8	4-006173-001	• PWBA, Protection/Metering (A10)			1
9	4-404519-001	• Meter, Amplifier (M401)			1
10	1-924018-001	• Switch, Circuit Breaker (CB1)	203-222-1-62-103-4-1-1	07355	1
11	1-951069-004	• Switch, Rocker (S402, S403)	7101J51CQE-2-2	09353	1
12	1-951069-003	• Switch, Lever (S4)	7201-J61	09353	1
13	1-939003-001	• Fan (B1, B2, B3)	7600S	23936	1
14	1-919024-001	• Filter, Power Line (FL1, FL2)	20B6	05245	1
15	1-942047-103	• Relay, Sensitive (K1, K2)	R10E1Y4S450	77342	1
16	1-998728-001	• Shunt, D.C. Ammeter (R1)	A-75-100	03030	1
17	1-951068-005	• Switch, Coaxial (K3)	02-218A10L	50667	1
18	3-006329-001	• Attenuator Assy (A9)			1
19	1-945001-210	• Res., 100K, 1/2 W (R2)	RC20GF104J5	COML	1

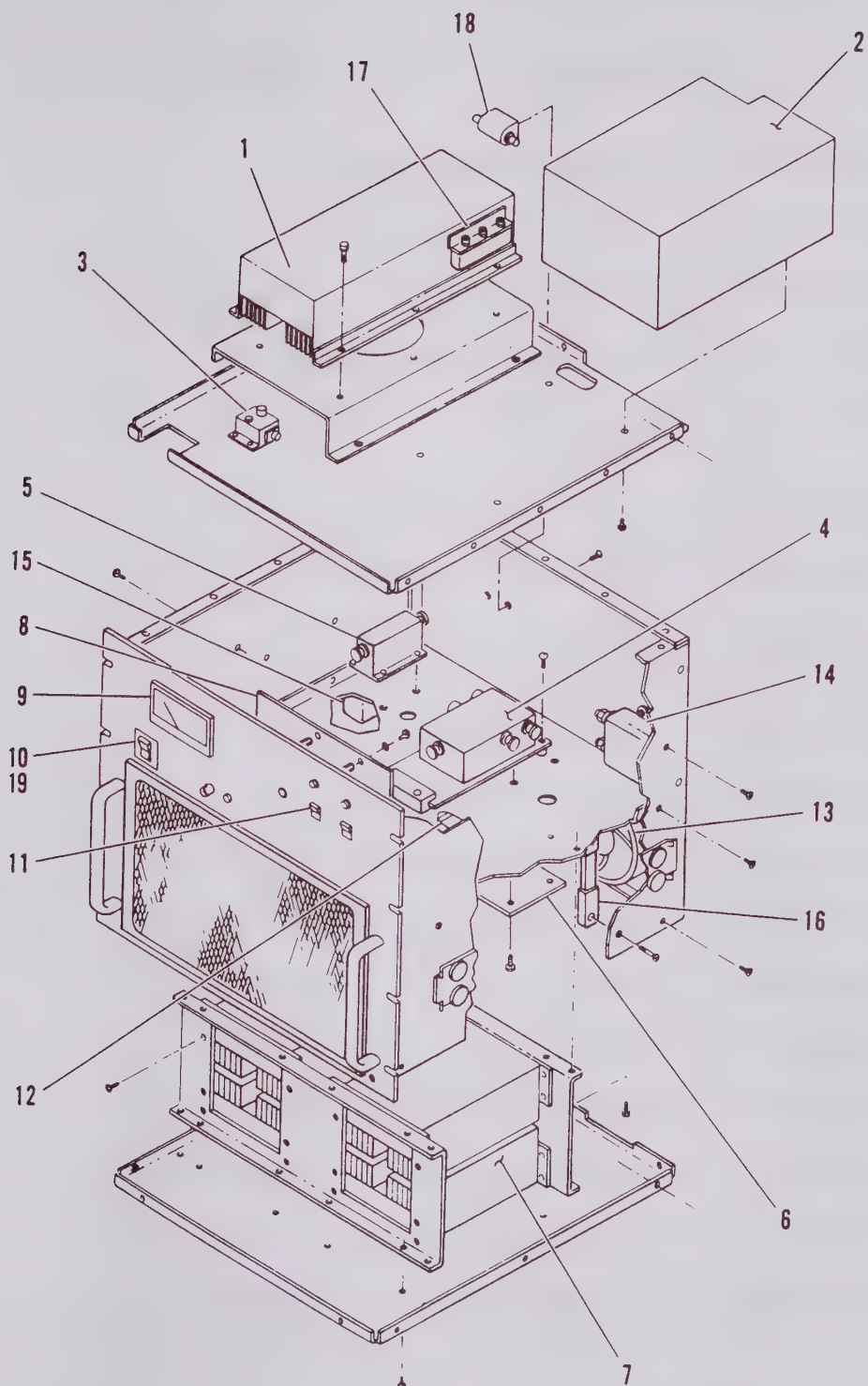


Figure 8-3. Amplifier 363/150 Exploded View

Fig Item	AMT Part No.	Nomenclature	MFG Part No.	FSCM	Units Per Assy
8-4	4-006239-001	Final Assy, Amplifier 363/500			REF
1	4-006244-001	• Amplifier Assy, Driver (A5)			1
2	1-998602-001	• Power Supply (PS1)	10JG00D-0093	11726	1
3	3-006157-001	• Diode Assy, Pin Switch (A6)			1
4	4-006217-001	• Combiner/Splitter Assy (A7, A8)			2
5	3-404536-001	• Coupler Assy, Directional (DC1)	4162-240	70998	1
6	3-006302-001	• PWBA, Current Monitor (A11)			1
7	4-006219-001	• Amplifier Assy, Output Module (A1, A2, A3, A4)			4
8	4-006173-001	• PWBA, Protection/Metering (A10)			1
9	4-404533-001	• Meter, Amplifier (M401)			1
10	1-924018-001	• Switch, Circuit Breaker (CB1)	203-222-1-62-103-4-1-1	07355	1
11	1-951069-004	• Switch, Rocker (S402, S403)	7101J51CQE-2-2	09353	1
12	1-951069-003	• Switch, Lever (S4)	7201-J61	09353	1
13	1-939003-001	• Fan (B1, B2, B3)	7600S	23936	3
14	1-919024-001	• Filter, Power Line (FL1, FL2)	20B6	05245	2
15	1-924047-103	• Relay, Sensitive (K1)	R10E1Y4S450	77342	2
16	1-998728-001	• Shunt, D.C. Ammeter (R1)	A-75-100	03030	1
17	1-945001-210	• Res., 100K 1/2 W (R2)	RC20GF104J5	COML	1

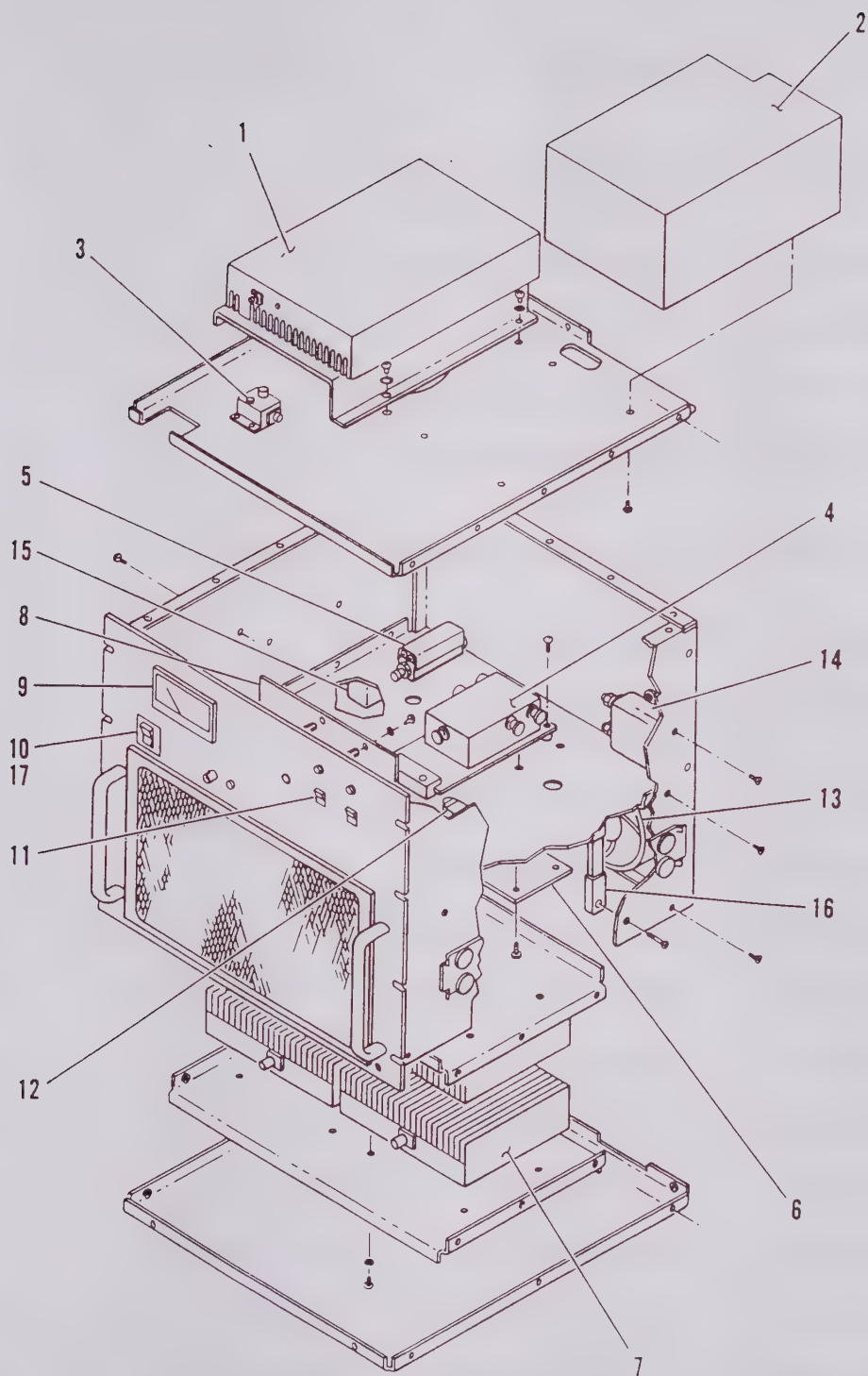


Figure 8-4. Amplifier 363/500 Exploded View

Fig Item	AMT Part No.	Nomenclature	MFG Part No.	FSCM	Units Per Assy
8-5	4-006240-001	Final Assy, Amplifier 363/1000 (See Fig. 8-1 for NHA)			REF
1	4-006248-001	• Amplifier Assy, Driver (A5)			1
2	1-998602-001	• Power Supply (PS1)	10JG00D-0093	11726	1
3	3-006157-001	• Diode Assy, Pin Switch (A6)			1
4	4-006216-001	• Combiner/Splitter Assy (A7, A8)			2
5	3-404536-002	• Coupler Assy, Directional (DC1)	4162-250	70998	1
6	3-006302-001	• PWBA, Current Monitor (A11)			1
7	4-006218-001	• Amplifier Assy, Output Module (A1, A2, A3, A4)			4
8	4-006173-001	• PWBA, Protection/Metering (A10)			1
9	4-404549-001	• Meter, Amplifier (M401)			1
10	1-924018-002	• Switch, Circuit Breaker (CB1)	203-222-1-62-103-4-1-1	07355	1
11	1-951069-004	• Switch, Rocker (S402, S403)	7101J51CQE-2-2	09353	2
12	1-951069-003	• Switch, Lever (S4)	7201-J61	09353	1
13	1-939003-001	• Fan (B1, B2, B3)	7600S	23936	3
14	1-919024-001	• Filter, Power Line (FL1, FL2)	20B6	05245	2
15	1-942047-103	• Relay, Sensitive (K1)	R10E1Y4S450	77342	2
16	1-998728-001	• Shunt, D.C. Ammeter (R1)	A-75-100	03030	1
17	1-945001-210	• Res., 100K, 1/2 W (R2)	RC20GF104J5	COML	1

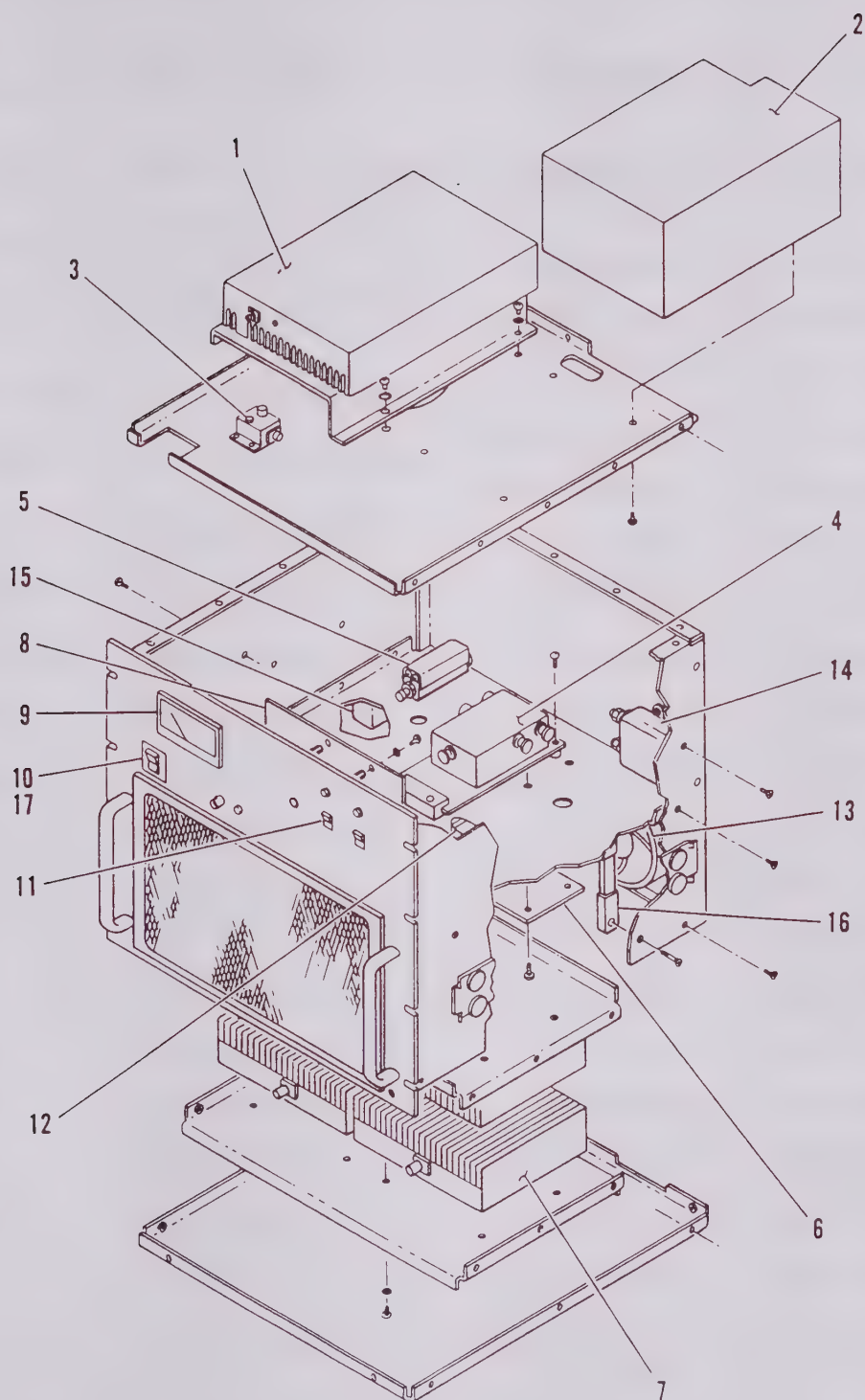


Figure 8-5. Amplifier 363/1000 Exploded View

Fig Item	AMT Part No.	Nomenclature	MFG Part No.	FSCM	Units Per Assy
8-6	4-006318-001	Final Assy, System Controller 363/488 (See Fig. 8-1 for NHA)			REF
1	1-998603-001	• Power Supply, +5V (PS1)	SPS15-5	51106	1
2	1-951068-004	• Switch, Coaxial (K8)	02-118K1-01L	50667	1
3	3-404666-001	• Relay (K1)			1
4	3-404667-001	• Relay (K4, K5, K6, K7)			4
5	3-404665-001	• Relay (K2, K3, K9)			3
6	1-404526-005	• Filter (FL5)	HKB721L300N	OEK43	1
7	1-404526-004	• Filter (FL4)	HKB721L180N	OEK43	1
8	1-404526-003	• Filter (FL3)	HKKB721L00N	OEK43	1
9	1-404526-002	• Filter (FL2)	HKB721L6R2N	OEK43	1
10	1-404526-001	• Filter (FL1)	HKB721L3R6N	OEK43	1
11	1-404739-001	• Filter (FL6)	HCB722L510N	OEK43	1
12	1-404739-002	• Filter (FL7)	HCB722L910N	OEK43	1
13	1-404739-003	• Filter (FL8)	HCB722L151N	OEK43	1
14	1-404739-004	• Filter (FL9)	HCB722L241N	OEK43	
15	1-404739-005	• Filter (FL10)	HCB722L361N	OEK43	1
16	1-404739-006	• Filter (FL11)	HCB722L501N	OEK43	
17	1-404578-007	• Filter (FL12)	HCB722L751N	OEK43	1
18	1-404739-008	• Filter (FL13)	HCB722L102N	OEK43	1
19	1-006314-001	• PWBBA, Logic			1
20	1-910330-101	• Module, Line Power/Line Filter (FL14)	6J4	05245	1
21	1-924000-014	• Fuse, Cartridge, 1/2 Amp S.B. (F1)	MNNL-.500	71400	1

Fig Item	AMT Part No.	Nomenclature	MFG Part No.	FSCM	Units Per Assy
22	3-404536-004	• Sampler, R.F. (A3)	4147-030	70998	1
23	4-006252-001	• WPBA, Interface (A2)			1
24	1-951069-003	• Switch, Operate/Standby (S2)	7201-J61	09353	1
25	1-404585-001	• Switch, Meter Select (S3)			1
26	1-404585-001	• Switch, Frequency Select			1
27	1-910423-101	• Connector, Adapter (J16)			1
28	1-951066-001	• Switch, On/Off (s4)	7201-J62-ZQ-2-2	09353	1
29	4-404587-001	• Meter, Current (M2)			1
30	4-404588-001	• Meter, Voltage (M1)			1
31	1-998111-001	• Coupler, Directional (DC1)	ZFDC-10-21-1A	15542	1
32	1-972011-001	• Attenuator, 0.1 dB (AT3)	RA-53	23042	1
33	1-972011-002	• Attenuator, 1.0 dB (AT2)	RA-51	23042	1
34	1-972011-003	• Attenuator, 10 dB (AT1)	RA-50	23042	1

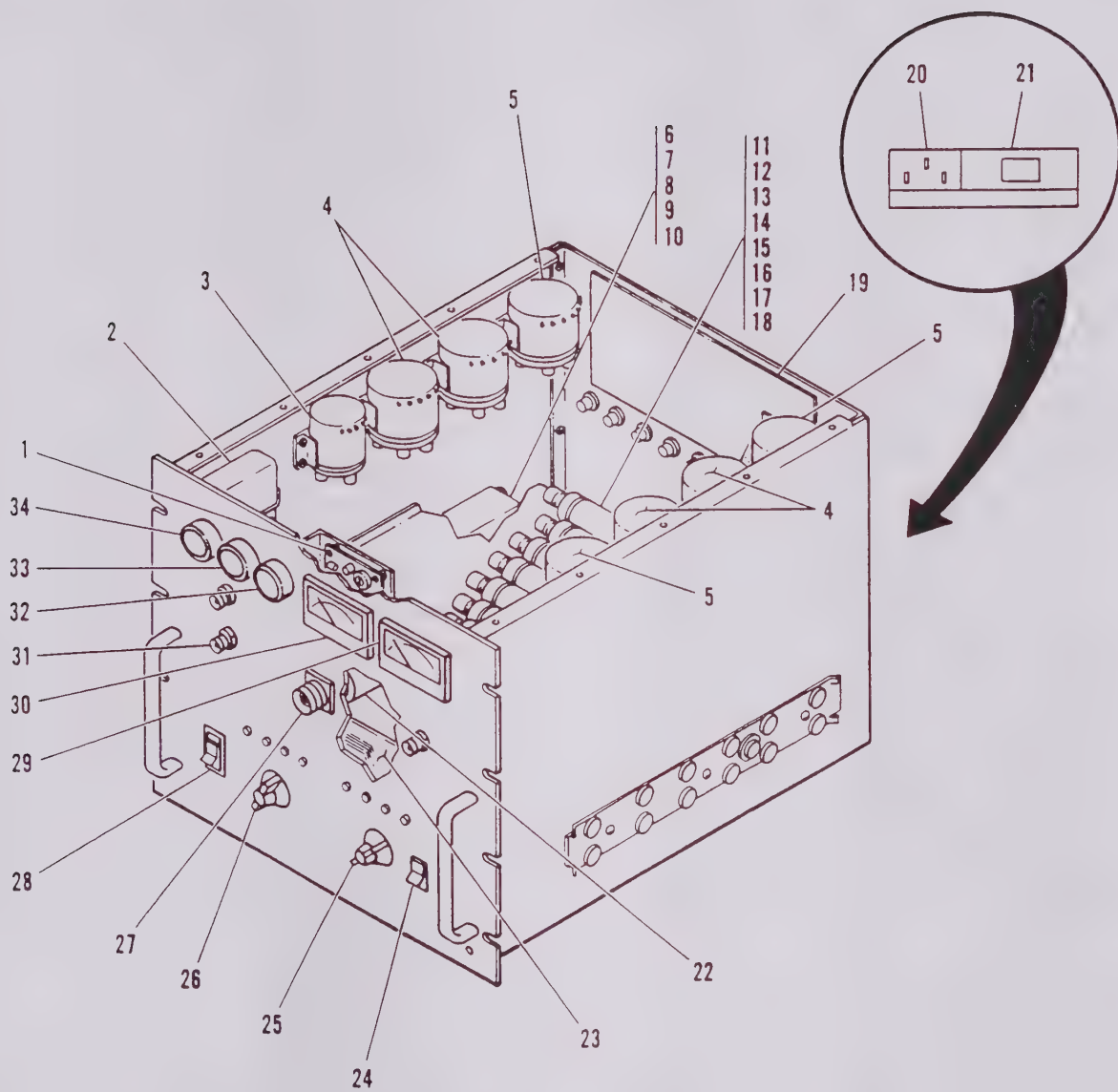


Figure 8-6. System Controller 363/800 Details

NUMERICAL INDEX

AMT <u>Part No.</u>	<u>Figure</u>	Item <u>No.</u>	AMT <u>Part No.</u>	<u>Figure</u>	Item <u>No.</u>
1-404526-001	8-6	10	1-942047-103	8-4	15
1-404526-002	8-6	9	1-942047-103	8-5	15
1-404526-003	8-6	8	1-945001-169	8-2	18
1-404526-004	8-6	7	1-945001-210	8-2	19
1-404526-005	8-6	6	1-945001-210	8-3	19
1-404578-001	8-6	11	1-945001-210	8-4	17
1-404578-002	8-6	12	1-945001-210	8-5	17
1-404578-003	8-6	13	1-951066-001	8-6	28
1-404578-004	8-6	14	1-951068-004	8-6	2
1-404578-005	8-6	15	1-951068-005	8-3	17
1-404578-006	8-6	16	1-951069-003	8-2	12
1-404578-007	8-6	17	1-951069-003	8-3	12
1-404578-008	8-6	18	1-951069-003	8-4	12
1-404585-001	8-6	25	1-951069-003	8-5	12
1-404585-001	8-6	26	1-951069-003	8-6	24
1-910330-101	8-6	20	1-951069-004	8-2	11
1-910423-101	8-6	27	1-951069-004	8-3	11
1-913231-001	8-2	17	1-951069-004	8-4	11
1-919024-001	8-2	14	1-951069-004	8-5	11
1-919024-001	8-3	14	1-968016-001	8-2	1
1-919024-001	8-4	14	1-972011-001	8-6	32
1-919024-001	8-5	14	1-972011-002	8-6	33
1-924000-014	8-6	21	1-972011-003	8-6	34
1-924018-001	8-3	10	1-998111-001	8-6	31
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1-924018-002	8-2	10	1-998602-001	8-4	2
1-939003-001	8-2	13	1-998602-001	8-5	2
1-939003-003	8-3	13	1-998603-001	8-6	1
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1-939003-001	8-5	13	1-998728-001	8-3	16
1-942047-103	8-2	15	1-998728-001	8-4	16
1-942047-103	8-3	15	1-998728-001	8-5	16

NUMERICAL INDEX

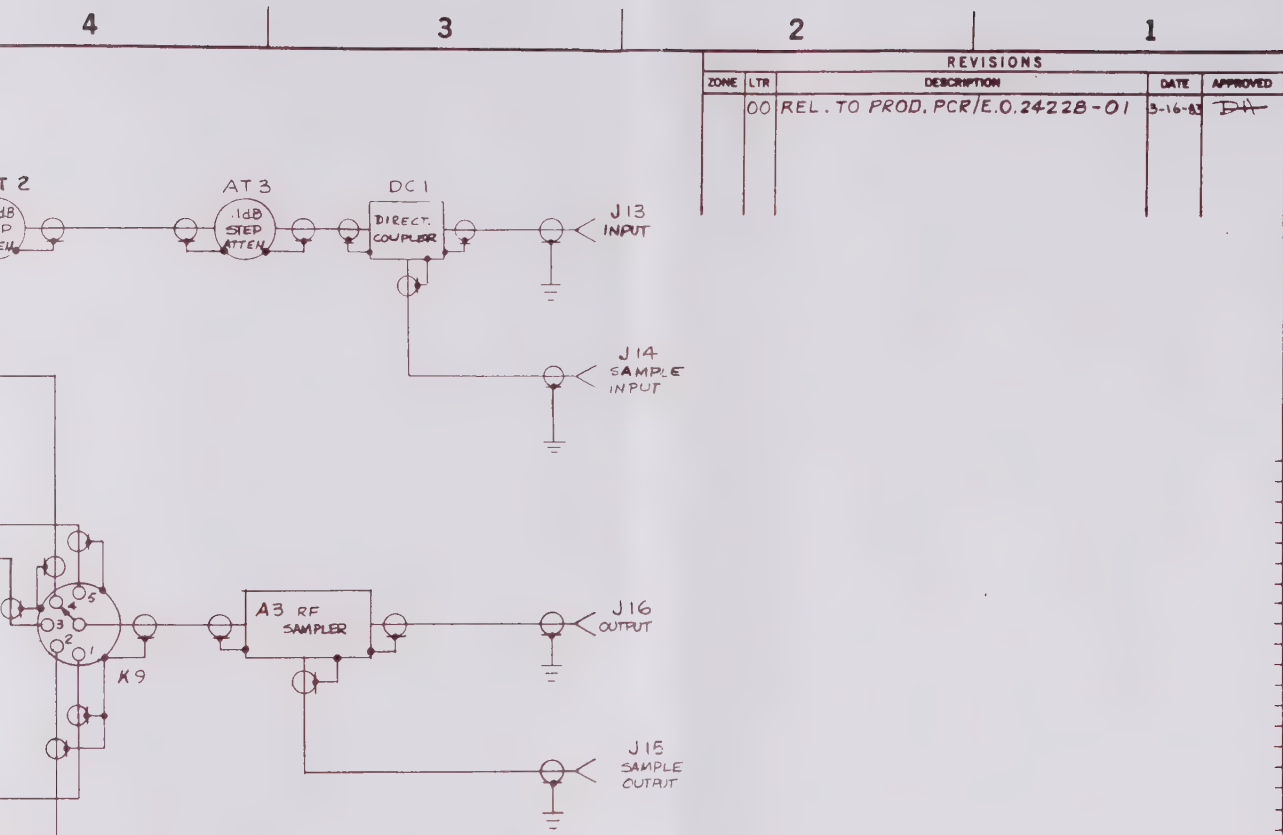
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3-006157-001	8-3	3	4-006216-001	8-5	4
3-006157-001	8-4	3	4-006217-001	8-4	4
3-006157-001	8-5	3	4-006218-001	8-5	7
3-006302-001	8-2	6	4-006219-001	8-4	7
3-006302-001	8-3	6	4-006235-001	8-2	3
3-006302-001	8-4	6	4-006237-001	8-1	REF
3-006302-001	8-5	6	4-006238-001	8-1	1
3-006329-001	8-3	18	4-006238-001	8-2	REF
3-404536-001	8-4	5	4-006239-001	8-1	3
3-404536-002	8-5	5	4-006239-001	8-4	REF
3-404536-003	8-2	5	4-006240-001	8-1	4
3-404536-004	8-6	22	4-006240-001	8-5	REF
3-404665-001	8-6	5	4-006244-001	8-4	1
3-404666-001	8-6	3	4-006248-001	8-5	1
3-404667-001	8-6	4	4-006252-001	8-6	23
4-006156-001	8-3	1	4-006293-001	8-2	7
4-006173-001	8-2	8	4-006314-001	8-6	19
4-006173-001	8-3	8	4-006318-001	8-1	5
4-006173-001	8-4	8	4-006318-001	8-6	REF
4-006173-001	8-5	8	4-404519-001	8-3	9
4-006175-001	8-3	5	4-404533-001	8-4	9
4-006187-001	8-3	7	4-404549-001	8-5	9
4-006188-001	8-2	4	4-404550-001	8-2	9
4-006188-001	8-3	4	4-404587-001	8-6	29
4-006189-001	8-1	2	4-404588-001	8-6	30
4-006189-001	8-3	REF			

APPENDIX

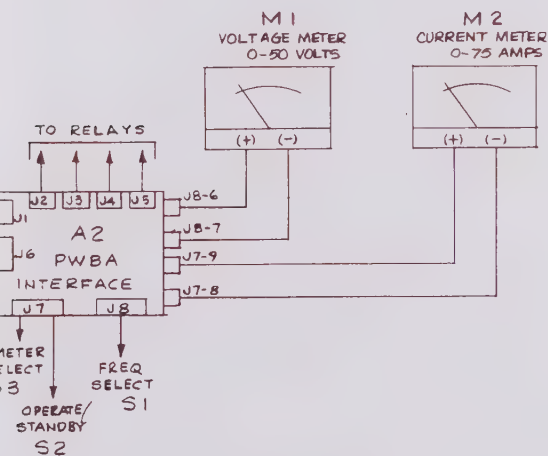
APPENDIX

This Appendix contains schematics/wiring diagrams for the modules of the 363/800 Wattmeter Calibration System. The following diagrams are included:

<u>Drawing No.</u>	<u>Title</u>
4-501925-001	Interconnect Block Diagram 363/30
4-501891-001	Interconnect Block Diagram 363/150
4-501923-001	Interconnect Block Diagram 363/500, 363/1000
4-501893-001	Interconnect Block Diagram 363/488



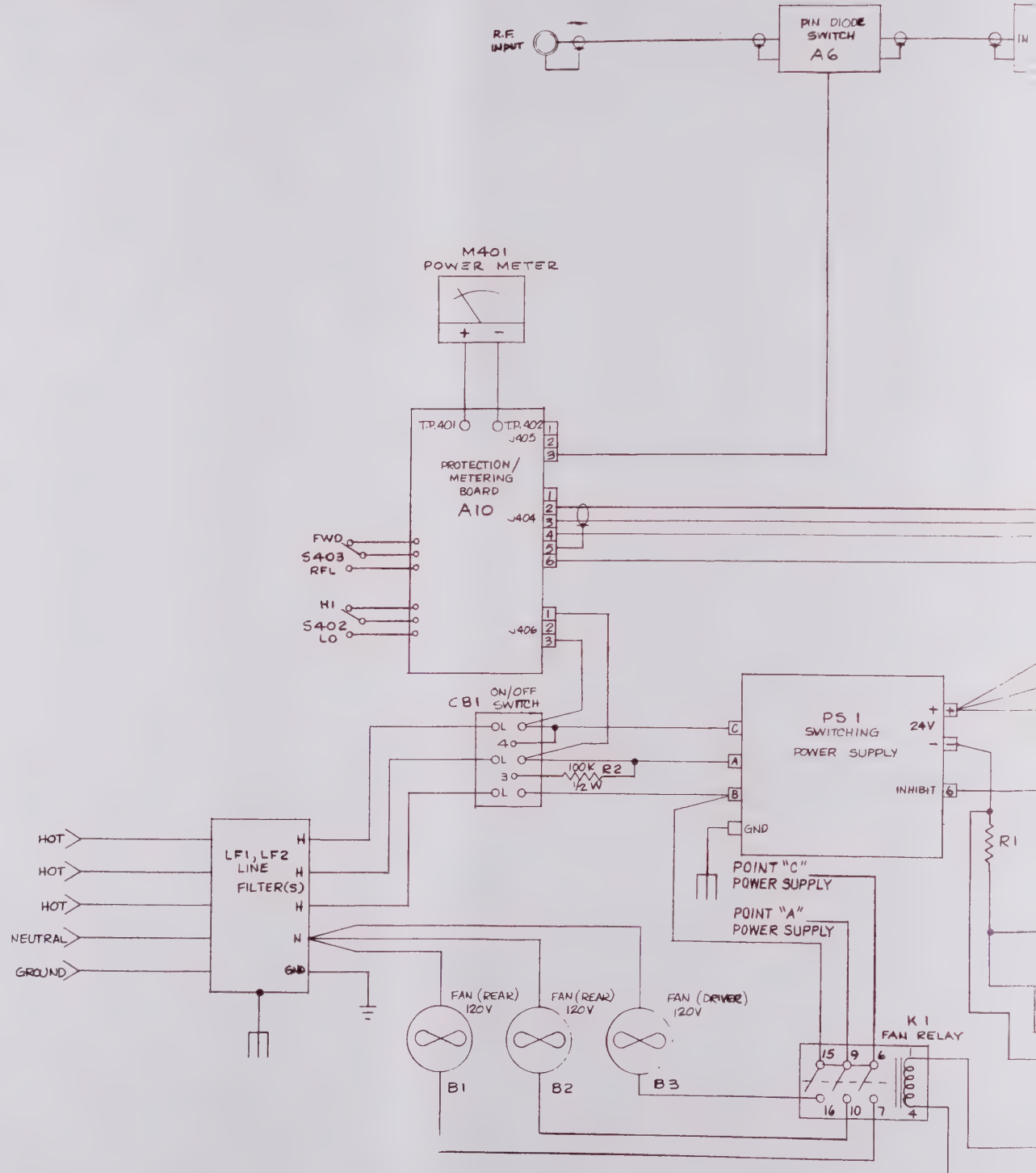
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	00	REL. TO PROD. PCR/E.O.24-22B-01	3-16-83	DA



QUANTITY REQUIRED		DESCRIPTION		PART NO.	ITEM
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DIMENSIONS		CONTRACT NO.		LIST OF MATERIALS	
DECIMAL	ANGULAR	NAME	DATE	AMERICAN MICROWAVE TECHNOLOGY INC. INTERCONNECT BLOCK DIAGRAM 363/488	
2 PLACE ±	3 PLACE ±	DRAWN	D. WETZEL 6-16-82		
		CHECK	DA 3-16-83		
		ELEC ENGR			
MATERIAL		MECH ENGR	DA 3-16-83		
FINISH		APPROVED	DA 3-16-83		
MODEL NO. 363/488		SCHEMATIC NO.		SIZE	REV
		NEXT ASSEMBLY NO. 4-006318-001		D 88869	4-501893-001 00
DO NOT SCALE DRAWING		SCALE		SHEET 1 OF 1	

METRIC CONVERSION TABLE

U.S. UNITS		METRIC UNITS		U.S. UNITS		METRIC UNITS	
INCHES		mm		INCHES		mm	
1/8		3.175		1/4		6.350	
1/4		6.350		3/8		9.525	
3/8		9.525		1/2		12.700	
1/2		12.700		5/8		15.875	
5/8		15.875		3/4		19.050	
3/4		19.050		7/8		22.225	
7/8		22.225		1		25.400	



NOTES: UNLESS OTHERWISE SPECIFIED

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				REVISIONS			
ZONE	LTR	DESCRIPTION		DATE	APPROVED		
	00	REL. FOR PROD. PCR/E.O. 24228-01		21 83	DH		

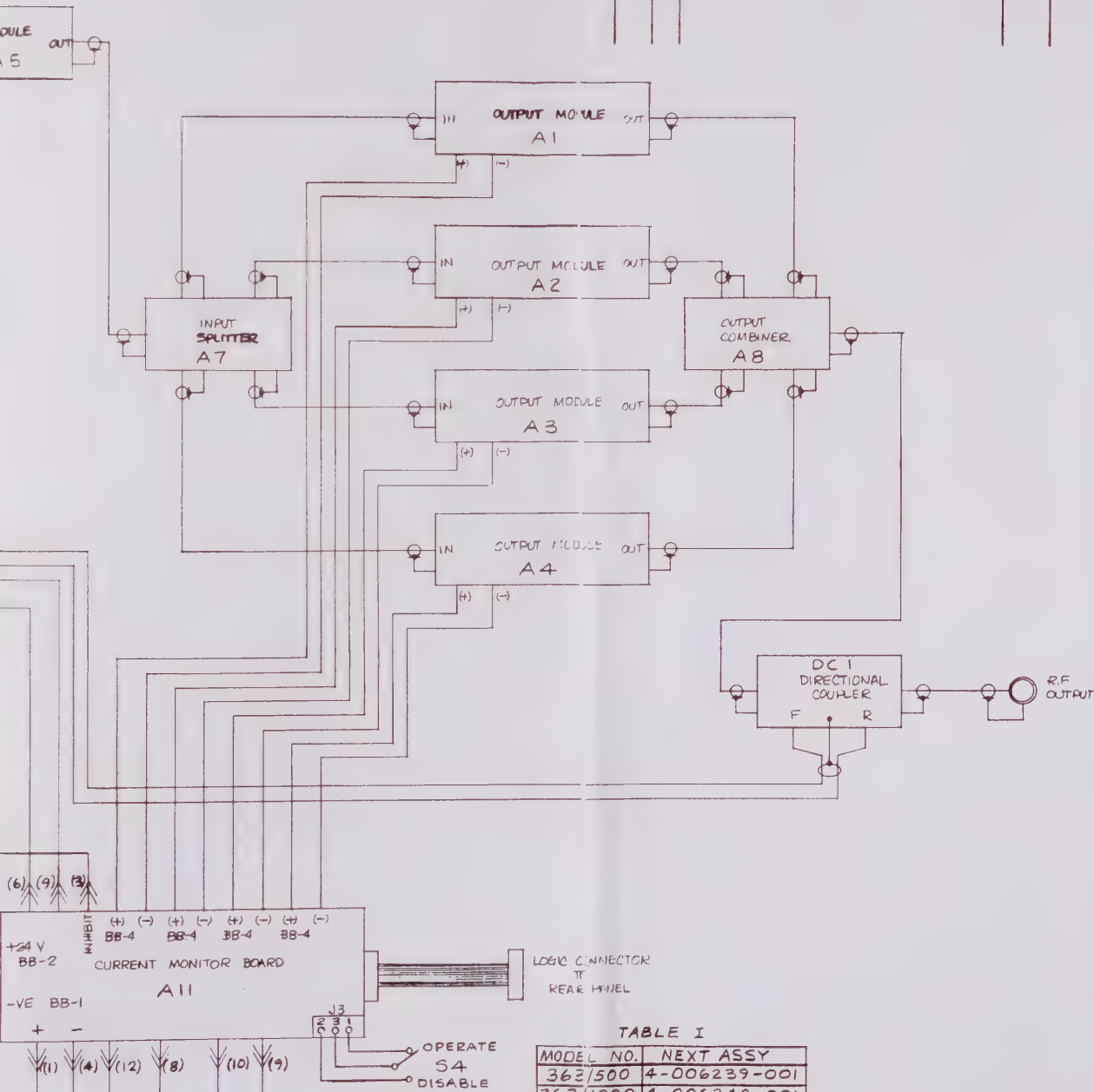


TABLE I

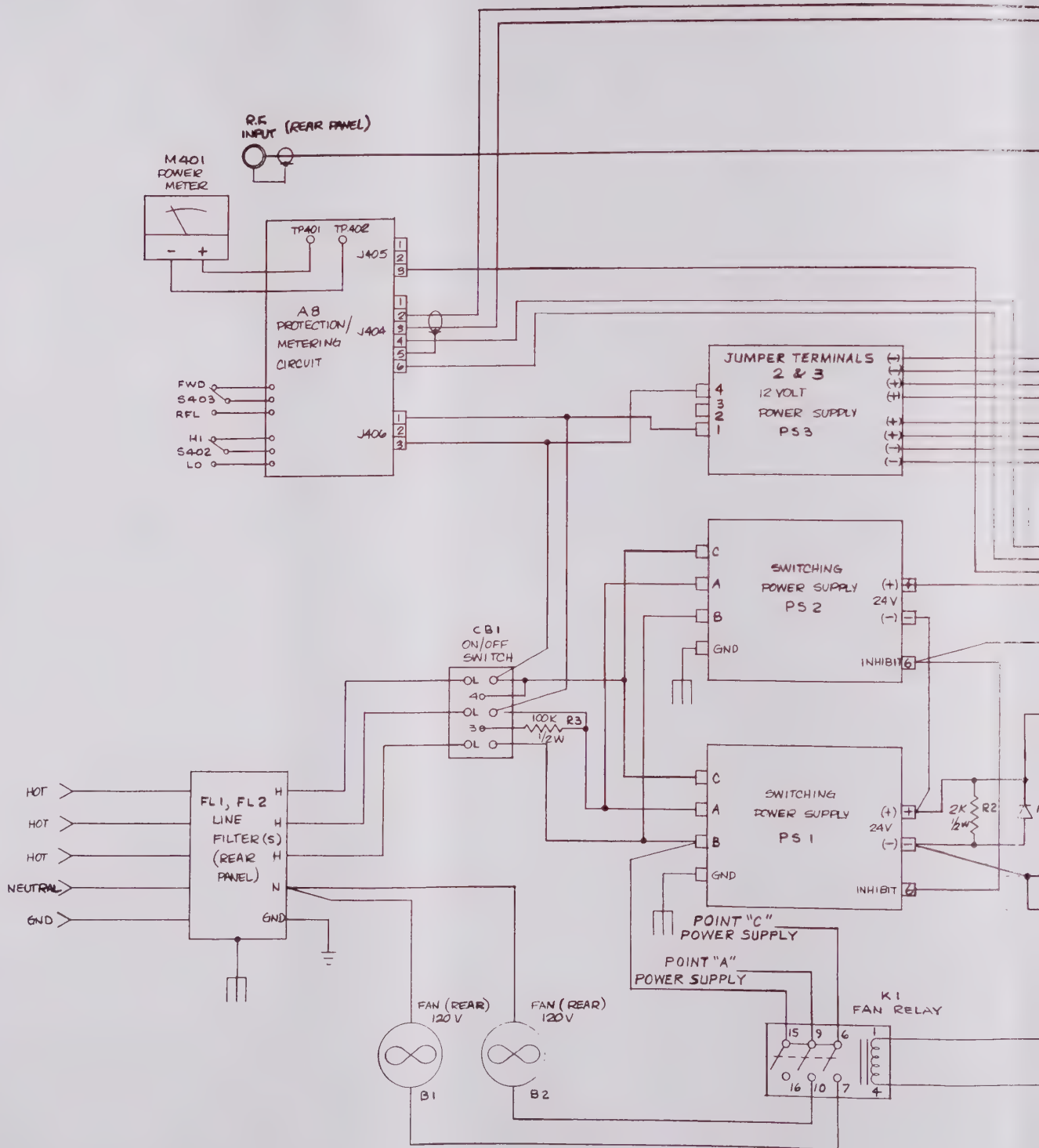
MODEL NO.	NEXT ASSY
363/500	4-006239-001
363/1000	4-006240-001

-005 -004 -003 -002 -001					DESCRIPTION		PART NO.	ITEM	
QUANTITY REQUIRED					LIST OF MATERIALS				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DIMENSIONS DECIMAL ANGULAR 2 PLACE ± ° 3 PLACE ± °					CONTRACT NO.		AMERICAN MICROWAVE TECHNOLOGY INC.		
					DRAWN	NAME	DATE	INTERCONNECT BLOCK DIAGRAM 363/500 363/1000	
					CHECK	TITLE	3-18-83		
					ELEC ENGR	DATE	5-18-83		
					MECH ENGR	DATE	3-18-83		
MATERIAL					APPROVED	DATE	3-18-83		
FINISH					SCHEMATIC NO.		SIZE	FSCM NO.	
MODEL NO.					NEXT ASSEMBLY NO.		D 88869		
SEE TABLE I					SEE TABLE I		4-501923-001		
					SCALE		SHEET 1 OF 1		

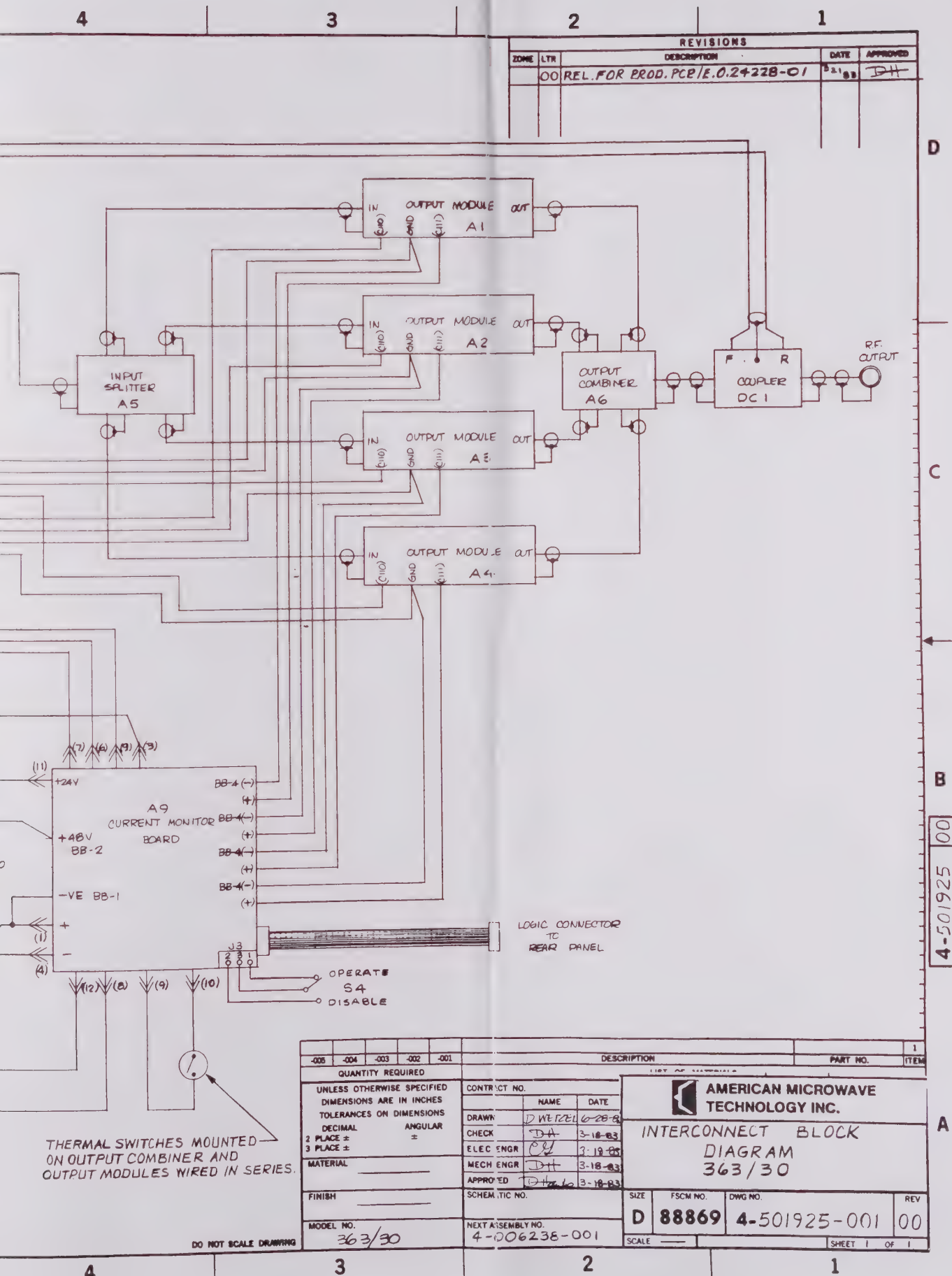
THESE DIMENSIONS ARE FOR INFORMATION ONLY. THE DIMENSIONS OF THE PARTS ARE NOT TO BE USED AS A BASIS FOR THE DESIGN OF THE PARTS. THE DIMENSIONS OF THE PARTS ARE NOT TO BE USED AS A BASIS FOR THE DESIGN OF THE PARTS.

INCH-TO-METRIC CONVERSION TABLE

U.S. UNITS	METRIC UNITS	U.S. UNITS	METRIC UNITS
INCHES	MM	INCHES	MM
1/16	1.6	1/8	3.2
1/8	3.2	3/16	4.8
1/4	6.4	1/2	12.7
3/8	9.5	5/8	15.9
1/2	12.7	3/4	19.1
5/8	15.9	7/8	22.2
3/4	19.1	1	25.4



NOTES: UNLESS OTHERWISE SPECIFIED



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
00		REL. FOR PROD. PCB/E.O.24228-01	2-1-83	DH

-005					-004					-003					-002					-001					DESCRIPTION					PART NO.					ITEM														
QUANTITY REQUIRED																									CONTRACT NO.																								
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DIMENSIONS DECIMAL ANGULAR 2 PLACE ± ± 3 PLACE ± MATERIAL FINISH MODEL NO. 363/30																									DRAWN					NAME					DATE					AMERICAN MICROWAVE TECHNOLOGY INC. INTERCONNECT BLOCK DIAGRAM 363/30									
																									CHECK					DA					3-18-83														
																									ELEC ENGR					CH					7-19-85														
																									MECH ENGR					DH					3-18-83														
																									APPROVED					DH					3-18-83														
SCHEMATIC NO.																									SIZE					FSCM NO.					DWG NO.					REV									
NEXT ASSEMBLY NO.																									D 88869					4-501925-001					00														
SCALE																																			SHEET 1 OF 1														

THERMAL SWITCHES MOUNTED ON OUTPUT COMBINER AND OUTPUT MODULES WIRED IN SERIES.

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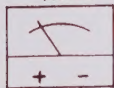
METRIC CONVERSION TABLE

U.S. UNITS	METRIC UNITS	U.S. UNITS	METRIC UNITS
INCHES	mm	INCHES	mm

FOR INFORMATION OF THE USER, THE FOLLOWING TABLES OF METRIC CONVERSION DATA ARE GIVEN. THIS DATA IS FOR INFORMATION ONLY. IT IS NOT TO BE USED AS A BASIS FOR DESIGN OR CONSTRUCTION. THE USER IS RESPONSIBLE FOR THE PROPER DESIGN AND CONSTRUCTION OF THE EQUIPMENT. THE USER IS RESPONSIBLE FOR THE PROPER DESIGN AND CONSTRUCTION OF THE EQUIPMENT.

AUX. RF OUTPUT (REAR PANEL)

R.F. INPUT (REAR PANEL)

PIN DIODE SWITCH
A6DRIVER MODULE
A5M401
POWER
METERTP401 O TP402
J405A10
PROTECTION/
METERING
CIRCUIT
J404FWD O
S403 O
RFL OHI O
S402 O
LO O

J406

CB1
ON/OFF
SWITCHOL O
40 O
OL O
30 O
OL O100K R2
1/2WPS1
SWITCHING
POWER SUPPLY24V
INHIBIT

POINT "C" PWR SUPPLY

POINT "A" PWR SUPPLY

HOT
HOT
HOT
NEUTRAL
GROUNDLF1, LF2 H
LINE
FILTER(S) H
(REAR PANEL)
H
N
GNDFAN (REAR)
120V
B1FAN (REAR)
120V
B2FAN (DRIVER)
120V
B3K1
FAN RELAYTHERMAL SWITCH
DRIVER AND OUTPUT
WIRED IN SERIES

127

PRODUCT #

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CLASS CODE

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